

SURGERY

Gynecology and Obstetrics

An International Journal of Surgery

FRANKLIN H MARTIN, M D

Founder and Managing Editor, 1905-1935

Volume 65

JULY TO DECEMBER, 1937

PUBLISHED BY

THE SURGICAL PUBLISHING COMPANY OF CHICAGO

54 EAST ERIE STREET, CHICAGO, ILLINOIS, U S A

ALLEN B KANAVEL, Editor

Associates

LOYAL DAVIS

SUMNER L KOCH

MICHAEL L MASON

CONSULTING EDITORS

UNITED STATES AND CANADA

WILLIAM J MAIO

GEORGE CRILE

HARVEY CUSHING

JOHN M T FINNEY

J BENTLEY SQUIER

WILLIAM R CUBBINS

WALTER W CHIPMAN

FRANK H LAHEY

PHILIP H KREUSCHER

FREDERIC A BESLEY

WALLACE I TERRY

DONALD C BALFOUR

PHILIP D WILSON

W EDWARD GALLIE

FLOYD E KEENE

GREAT BRITAIN

SIR JAMES WALTON

SIR DAVID WILKIE

G GREY TURNER



Argentina

JOSE ARCE

France

ANTONIN GOSSET

Australia

SIR ALAN NEWTON

Holland

JAN SCHOFMAKER

Brazil

LINCOLN DE ARAUJO

Italy

VITTORIO PUTTI

Scandinavia

EINAR KEY

CONTRIBUTORS TO VOLUME 65

ABRAMSON, DANIEL	335	IRAZIER, W D	11	MARTIN, HAYES E	793
ADAIR, FRED L	252	FULLER, MURIEL A	331	MAYO, CHARLES W	303
ARCE JOSÉ	178			MAZER CHARLES	32
ARIES, LEO J	385	GAINES, REUBEN B	366	MCARTHUR, SELIM W	715
		GATCH, W D	115	MCCAUGHAN, J M	824
BABCOCK W WAYNE	88	GEHREIS, ERNST	528	MCGOOGAN, LEON S	145
BACON, CHARLES M	220	GIBSON, JOHN G, 2d	741	MEALF, ERIC	40
BAKER, CLARENCE S	357	GLASCOCK, HAROLD	355	MILLER, GAVIN	489
BAKER HILLIER L	220	GLASCOCK, HAROLD, JR	355	MIRIZZI, P L	702
BAIFOUT DONALD C	551	GLENN FRANK	16, 540	MOORE, S W	16
BATLS, ROBERT R	545	GOLDSTEIN, ALBERT E	515	MURPHY, HUGH L	100
BEARDSLEY J MURRAY	685	GOLDSTEIN, LEOPOLD	644		
BEER, EDWIN	433	GOREN, MORRIS L	690	NETTROUT, WALTER SCOTT	303
BEHREND MOSES	505	GRATZ, CHARLES MURRAY	700	NEW, GORDON B	45 330
BEST R RUSSELL	717	GROSS, ROBERT E	289	NORDLAND MARTIN	73
BISGARD, J DEWEY	99 464	GUTIERREZ, ROBERT	238		
BISSELL DOUGLAS	257			OCHS TER, ALTON	393
BLAISDELL, PAUL C	672	HATCHER, C HOWARD	721	O'CONNOR, GERALD BROWN	523
BLAND, P BROOKE	644	HAWLEY, GEORGE W	228	OPPENHEIMER, GORDON D	829
BLUM LESTER	812	HAYES, JAMES M	306	ORR, H WINNETT	712
BOYLES, H E	340	HEAD, JEROME R	123 485		
BOYDEN, ALLYN M	495	HEGNER, C F	554	PEARL, FELIX L	107
BRANCH, CHARLES D	741	HENDERSON, MELVIN S	711	PEABERTON, JOHN DEJ	97, 249
BROWN, ARTHUR E	708	HERRELL, WALLACE E	666	PHENISTER, DALLAS B	721
BROWN, JAMES BARRETT	562	HERRICK, FREDERICK C	68	PIERCE GEORGE WARREN	523
BRUCE, JOHN	40	HEYD, CHARLES GORDON	530 688	PRICE, AARON SUM TER	748
BRUNSCHWIG, ALEXANDER	681	HICKEN N FREDERICK	217		
		HILL, LUTHER L, JR	475	RANDALL, LAWRENCE M	666
CABOT HUGH	188	HURWITT, ELMOTT	335	RAVIA, I S	11
CAMERON, J LYLE	679			REGATO, J A DEL	657
CAREY, J B	447	IRVING, FREDERICK C	23	RIVES JAMES DAVIDSON	164
CLARK, G N	771	ISRAEL, S LEON	30	ROBERTS, LOUIS	753
CLIFFORD STEWART H	23	IVY, ROBERT H	640	ROMANO, SAMUEL A	164
COGSWELL, H D	837			ROSENBAUM, M G	231
COLE, JAMES P	55	JACKSON ARNOLD S	1	RUDDOCK, JOHN C	623 843
COLLER, FREDERICK A	495	JARCHO, JULIUS	593		
COLT, G H	771	JARVIS CHARLES	820	SACHS, ERNEST	253
COOK, DONALD D MACKENZIE	331	JOHNSON, CARL A	438	SANDIFER, FRED MONROE, JR	164
COLGHLIN, W T	824	JOHNSON, KATHERINE S	601	SCHULHOF, MAURICE GEORGE	168
CRIMM PAUL D	357	JONES RANDOLPH, JR	753	SHORT, DARWIN M	357
CURTIS, LAWRENCE	640			SHUTE, EVAN	480
		KACHER, LEO	30	SIDDALL, R S	820
DALAND ERNEST M	807	KIMBLEY, A GURNLEY	195	SINGLETON, ALBERT O	394
DAVISON, MARSHALL	385	KUNATH CARL A	79	SMITH, CLINTON K	380
DECOURCY, JOSEPH L	180			STEWART, COLIN C	845
DOLGLASS, MARION	534	LABATE JOHN S	321	STOCKWELL, A LLOYD	380
DRAGSTEDT, LESTER R	104 113	LAFFERTÉ, A D	231	STONE, HARVEY B	383
DYAS FREDERICK G	600	LESVICK, GERSON	335	SZANTÓ, G	453
		LEWIN, PHILIP	398		
EDWARDS, EDWARD A	310	LUND, CHARLES C	788	TAYLOR GRANTLEY W	807
EDWARDS, JESSE E	310			TORREY, M ALLEN	601
ERICH JOHN B	48	MAES, URBAN	841	TROUT, HUGH H	370
FINLAYSON, B	159	MARTENSON, LEE	464	TRYNN, AARON H	379

VOLINI, I F	159	WHITE, EDWARD WILLIAM	366	WISE, WALTER D
		WHITTAKER LORIN D	92	WOOD JAMES C
WALTER, OTIS M	331	WIDENHORN, H L	159	
WALTERS, WALTERMAN	695	WILLIS DAVID A	698	YOUNG FORREST
WAUGH, JOHN M	249	WILSON, HARVEY	104	
WESSON, HARRISON P	695	WILSON ROBERT A	601	ZBITKOFF, NICHOLAS



Case 1 Crestly thickened and indurated terminal ileum with involvement of mesenteric glands

Case 3 Regional enteritis involving two segments of the ileum
Note the enlarged mesenteric glands



SURGERY

GYNECOLOGY AND OBSTETRICS

An International Magazine, Published Monthly

VOLUME 62

JULY, 1937

NUMBER 1

REGIONAL ENTERITIS

ARNOLD S. JACKSON, M.D., F.A.C.S., Madison, Wisconsin

NO SUBJECT in surgery has created more discussion and interest in so short a period as has regional ileitis, as it was first designated by Crohn (10) and his associates in 1932. Although only 4 years have elapsed since their article twenty-seven treatises dealing with this disease have appeared in American medical literature. The subject has aroused the interest of surgeons, internists, roentgenologists, pathologists, and research students. As it has not previously been discussed before this society, opportunity is taken to present our cases with a summary of those of other members. To the 114 cases which have appeared in the American literature, there are added 4 in our series and 64 from the members of the society, making a total of 182 cases. I wish to pay recognition to the excellent article appearing on this subject in SURGERY, GYNECOLOGY AND OBSTETRICS, by one of our members Dr. Karl A. Meyer.

As one becomes familiar with its rather characteristic symptoms, he is inclined to conjecture how many such cases he may have overlooked prior to 1932. Even now, undoubtedly many innocent appendices are being removed while the real source of the discomfort is overlooked. If more need be said

as to the inadequacy of the formerly popular button hole incision, it might be urged that even the remote possibility of ileitis demands an adequate abdominal exploration when conditions permit it. Regional enteritis, mesenteric lymphadenitis, a diseased Meckel's diverticulum, and lesions of the gall bladder and pelvis are but a few of the pathological entities which, through inadequate exposure, may escape the surgeon's eye.

Mesenteric lymphadenitis is undoubtedly akin to regional enteritis, both possibly being due to low grade infections of the lymphatic system. Both are baffling as to diagnosis and etiology. The classical paper of Leonard Freeman first focused our attention on that then mysterious entity, mesenteric lymphadenitis, now so well known that occasionally it may be diagnosed prior to operation. This condition also should not be overlooked at operation, for such patients may likewise continue to complain of abdominal distress for months following an appendectomy. It behooves the surgeon to explain this to relatives at time of operation. Everett Coleman has told us that fortunately in the majority of these cases recovery eventually takes place.

Probably both lesions are due to a diseased lymphatic system. Lymphadenitis is characteristic of the former and may occur in the latter. In one of our cases the most striking appearance when the abdomen was opened

From the Jackson Clinic.
Presented before the Western Surgical Society at Kansas City
December 11, 1936.



Fig 1 Specimen of the terminal ileum the cecum and part of the ascending colon

tion of the small intestine. A mass is usually palpable. Violent cramps, occasional attacks of vomiting, and constipation occur.

Group 4. In this stage multiple fistulas are formed that may open either internally or externally through the abdominal wall. Roentgenological examination may reveal these fistulas, which persist and resist surgical measures at closure, unless the bowel is resected.

The symptoms depend somewhat upon the location of the lesion, the higher the constriction the more pronounced are the symptoms of a high intestinal obstruction. The extent and the severity of the lesion determine the predominant symptoms. The most typical cases I have observed are those in young adults suffering from acute colic-like abdominal pains usually occurring 1 to 2 hours after eating, with nausea and vomiting. The pain in these cases is intermittent and yet severe enough to require morphine. Visible peristalsis may be observed. The age range has been from 16 to 56 years.

Determination of the diagnosis depends upon the roentgenologist. In the early stage



Fig 2 Resected portion of the ileum

the roentgenogram may reveal no characteristic lesion but as the chronic, stenotic form develops a filling defect in the terminal ileum with a mild ileal stasis and distention proximal to the defect appears. In cases with still greater stenosis, the lumen shows merely as a fine line of barium, described by Kantor as the "string sign." He has also called attention to three other significant roentgenological findings, namely, a filling defect just proximal to the cecum, an abnormality in contour of the last filled loop of ileum, and dilatation of ileal loops just proximal to the lesion.

Various conditions must be considered in the differential diagnosis, such as acute appendicitis, mesenteric lymphadenitis, ileocecal tuberculosis, intestinal obstruction, ulcerative colitis, neoplasm, and actinomycosis.

Pathological findings vary according to the stage of the disease. The involved section of



Fig. 3 Regional enteritis showing marked involvement of the terminal ileum with enlarged mesenteric glands

bowel, together with its mesentery, is greatly thickened and doughy, like a soggy hose. In the acute stages the diseased intestine may appear edematous and hyperemic or congested and of rather a maroon color. Mention has been made of the hyperplastic regional mesenteric glands. The mesentery may not be thickened and edematous. Karl Meyer believes that the state of the mesentery may be an indication as to treatment—that is, whether to resect, shortcircuit, or leave alone.

The inflammatory process may be limited to one segment of the bowel or as in one of our series, may involve several loops. Fistulas and walled off abscesses may be found between the loops of bowel. The intestinal coats are greatly thickened and edematous. Ulcerated areas may appear along the mesenteric border of the mucosa and show a tendency toward perforation. Microscopic study shows acute, subacute, or chronic inflammatory changes. Giant and epithelioid cells are present in the later stages.

TREATMENT

Proper surgical treatment is still a question for discussion and will not be determined until the results in cases in which operation has been done have been further studied.

Treatment must be governed by the progress of the disease and the condition of the patient. Many acute cases must occur in which spontaneous recovery results. What is the proper procedure when the acute phase is encountered? Mixer prefers a one stage resection in uncomplicated cases but feels that multiple stage operations are indicated when abscesses or fistulas exist. He believes that the hazards of operative intervention should be emphasized and points out that technically the operation is difficult due to severe hemorrhage caused by mobilization of the bowel, the extreme thickening of the mesentery, and at times the presence of complicating fistulas. Mixer does not favor graded procedures in the early cases and reports that he had no case in which a cure was accomplished short of resection of the diseased intestine.

Meyer believes that if the inflammation is limited to the terminal ileum and the mesentery is uninvolved, resection may not be necessary, since the process may resolve spontaneously. Even when ulceration of the ileum has extended into the mesentery, he feels that a shortcircuiting operation may suffice. This was my experience in Case 3 of our series.

I question the advisability of subjecting these rather poor surgical risks to the hazards



Fig. 4 Filling defect in the terminal ileum opaque meal administered by mouth

of resections of considerable portions of the small and large intestine. It might be well to permit sufficient time to elapse to observe what course the disease might follow. This is contrary to Mixer's experience, who states that he has observed in a very considerable number of cases without demonstrable fistulas or abscesses that the disease has progressed from a simple primary lesion following a first stage procedure, so that the second operation became definitely more hazardous. Mixer reports a mortality of 36 per cent. Dixon, however, feels that if the patient is in poor condition, an ileocolostomy is the procedure to be employed, subsequent resection depending on whether the patient is rendered symptom free by the short-circuiting operation. He believes that in more than 50 per cent of the cases resection will be necessary.

What is the fate of the sidetracked loop of bowel? In Case 3 in our series, roentgenological examination disclosed no abnormal changes. This is still open to discussion, as Holm found that the loop was likely to become greatly elongated, dilated, and ulcerated.

CASE REPORTS

The subject of regional enteritis merits our closest attention and our carefully considered



Fig. 5 Specimen injected after resection shows a characteristic filling defect

opinion. In order that future knowledge and experience in the care of this strange malady may be available to all, this preliminary study should be followed by a later survey. A summary of the cases seen at the Jackson Clinic together with a résumé of those of members of the Western Surgical Society follows.

CASE 1. Female, aged 56, years was first seen by my brother in 1909, at which time her age was 29, she had recently had four attacks of right lower quadrant pain, vomiting and diarrhea. A diagnosis of appendicitis was made and an interval operation was done. At operation, free, clear, serous fluid, grade 1, was noted. The wall of the terminal 2 1/2 inches of the ileum was found to be definitely thickened, edematous, anemic, and dusky in appearance. The appendix, which showed no evidence of acute inflammation, was removed. At the time, the water logged doughy condition of the terminal ileum with its dusky hue which also pervaded the fan shaped vascular supply area, was interpreted as due to a limited mesenteric thrombosis in which recovery of circulation was progressing favorably. Judging by subsequent history, this was the initial stage of a terminal ileitis.

From time of operation until 1922, patient had had attacks of abdominal cramps and vomiting which occurred every few months and lasted 2 to 3



THE "SUNSHINE" OF THE "SUNSHINE" ALLEY



Fig 8 Arrow points to concave filling defect in ileal cecal valve caused by protrusion of infiltrated ileal wall into cecum



Fig 9 String sign in terminal ileum

Blood examination showed hemoglobin 75 per cent red blood count 5,800,000 white blood count 13,500. The Kahn test gave negative reaction.

Roentgenograms of the gastrointestinal tract showed that in the prececal ileum there was cannulization of the lumen, and next to this marked dilatation. At 24 hour intervals, this cannulization was again demonstrated in the ileum, with retention proximal to the defect.

Diagnosis: regional ileitis.

Operation was done December 11, 1935. The lower ileum was explored and revealed a marked narrowing, thickening, and hypertrophy of the wall in the last 10 inches, with many enlarged glands in the mesentery. The healthy ileum wall above the lesion was anastomosed to the ascending colon. The patient made a good recovery.

Following the operation there were occasional attacks of dull pain lasting 2 to 5 hours, which gradually subsided. Patient is now a year after operation free from all symptoms, has gained 50 pounds, and eats whatever he desires.

CASE 4. Female, aged 16 years. This girl was admitted to the clinic March 17, 1936. Onset of present illness was in August, 1935, when she had abdominal cramps and vomited. A month later a similar attack occurred. In October the attacks became more frequent and in November the pain became localized in the right lower quadrant, she was operated upon elsewhere. The surgeon reported that on opening the abdomen he encountered an agglutinated mass of small bowel around the appendiceal region and in digging out the appendix, he opened a

There had been marked loss of weight and strength with secondary anemia. Roentgenological examination had not revealed the cause of the complaint.

Exploratory laparotomy revealed a most unusual and in our experience, unheard of condition. The first 3 feet of the jejunum presented what we now know to be the characteristic appearance of regional enteritis. On account of the location and extent of the lesion, resection was not feasible. The terminal duodenum and the proximal jejunum with their greatly thickened walls were approximately the size of the colon but gradually tapered off into normal walled jejunum. There was no proof of definite obstruction. The adjacent mesentery contained many enlarged glands. The patient survived a year.

CASE 3. Male, aged 26, entered the hospital December 3, 1935. In March, 1935, patient suffered with abdominal cramps, bloating, and diarrhea. Blood appeared in the stools 2 weeks later. Following appendectomy at another hospital in May, 1935 pain and diarrhea were relieved but persisted. In late November 1935, the abdominal cramps again became severe. During height of cramps, a mass was felt in abdomen which disappeared with cessation of pain. Total loss of weight 40 pounds.

Proctoscopic examination showed spastic bowel, edematous mucosa, but no evidence of ulceration.



Fig 10 Roentgenogram showing string sign in the terminal ileum



Fig 11 String sign in terminal ileum



Fig 12 Roentgenogram showing 4 hour retention in the terminal ileum

small abscess of creamy odorless pus in the meso appendix. The appendix itself was not greatly inflamed nor was it perforated. After the appendectomy a cigarette drain was placed to the site of the pus pocket; the resulting sinus remained patent for many weeks. Following operation the attacks of abdominal pain and vomiting continued with the development of anemia, loss of weight, and general lassitude. Temperature ranged from 100 to 101 degrees.

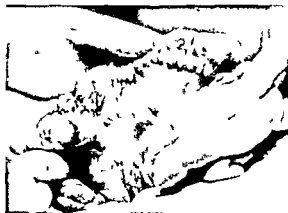


Fig 13 Regional enteritis showing enlarged mesenteric glands and hose like thickening of the last 8 inches of the ileum

TABLE I—CASES OF REGIONAL ENTERITIS REPORTED BY MEMBERS OF WESTERN SURGICAL SOCIETY

	Cases
Number of cases	64
Number operated upon	64
Result	
Cured	50
Improved	3
No change	1
Died	10
Type of operation	
Shortcircuit ileocolostomy	14
Resection	49
Appendectomy	9
Members reporting not having had a case	45

TABLE II—CASES OF REGIONAL ENTERITIS REPORTED BY JACKSON CLINIC

	Cases
Number of cases	5
Number operated upon	4
Result	
Cured	3
Improved	0
Died (1 year following operation)	1
Type of operation	
Shortcircuit ileocolostomy	1
Resection	2
Exploration	1

X ray diagnosis obstruction at the ileocecal valve

Clinical diagnosis terminal ileitis

Operation was done March 18, 1936 A typical hose like thickening of the last 18 inches of the ileum was found with several enlarged mesenteric glands

Surgical diagnosis regional ileitis

The affected ileum and half of the ascending colon were resected and lateral anastomosis was done

Figure 13 shows specimen during operation, and Figure 2 (below), specimen after removal The fresh specimen was sent at once to Professor C H Bunting who at first thought the etiological factor was due to a fungus organism but repeated efforts to cultivate this organism failed Figure 5 is a roentgenogram of the barium filled specimen There is a marked reduction in the lumen of about 20 centimeters in the distal ileum with cannulization in the prececal region

Diagnosis inflammatory infiltration of the wall of the distal ileum (regional ileitis)

Patient has remained well since operation

CASE 5 Female, aged 35 years, was first seen at the clinic March 31, 1936 For 2 months, she had had daily attacks of cramp like pain in the lower abdomen lasting 2 to 3 hours The pain occurred usually after the noon meal and was partially relieved by lying on the abdomen No borborygmus and no nausea or vomiting were associated with the pain, the bowels were constipated and the daily use of a laxative was required

Blood examination showed hemoglobin, 75 per cent, red blood cells, 3,400,000, white, 7,900

TABLE III—REPORTED CASES OF REGIONAL ENTERITIS IN THE UNITED STATES

	Cases
1932 Crohn B B, Ginzburg, I, Oppenheimer, G D	14
1933 Clute, H	2
1933 Harris, I I, Bell G H, Brunn, H *	3
1933 Homans J, Haas G M	2
1933 Iadd (Reported in discussion)	2
1933 Rockey, I W	4
1934 Brown P, Birgen J A, Weber, H	18
1934 Colp R	1
1934 Core P Boeck W	1
1934 Donchess, J C, Warren S	1
1934 Stout, I, Hoagensen, Smith	1
1934 De Courcy J I	1
1934 Bissell, A D	2
1934 Phillips K T	1
1935 Erb, I H Farmer A W	4
1935 Erdmann J I, Burt, C V	5
1935 Galamos A Mittelmann W	2
1935 Mixer C G	11
1936 Lee Discussion Mixer paper	1
1936 Goetsch I Discussion Mixer paper	1
1936 Brunn, H * Discussion Mixer paper	2
1936 Binney Discussion Mixer paper	2
1936 Strauss, A Rosenblate, A Goldsmith A	1
1936 Meyer, K	8
Reported in this Survey	2
1936 Connell, I G *	2
1936 Crohn, B, Rosenthal B	9
1936 Probstem J G, Gruenfeld, G	3
1936 Kantor J L	3
1936 Taylor, J L	2
1936 Jackson, A *, R H *	4
1936 Western Surgical Society Members	64
Total	182

NOTE Crohn recently reports a diagnosis of 60 cases or 37 more than already reported making a total of 219 cases reported in the United States to date

*Member Western Surgical Society

The gastro intestinal series of roentgenograms showed conspicuous evidence of cannulization of a loop of distal ileum immediately prececal ("string sign") Colon, by clyma Reflux into the ileum confirms the presence of a filling defect in the distal ileum as previously described

Diagnosis inflammatory infiltration into wall of distal ileum Clinical diagnosis regional ileitis

Operation was advised but refused, patient has not been seen since

SUMMARY

1 To the 114 cases of regional enteritis which have appeared in the American literature since Crohn's classical description in 1932, there are added 4 cases from the Jackson Clinic and 64 from a survey of the Western Surgical Society, making a total of 219 cases

2 Regional enteritis may simulate appendicitis and appendectomy has frequently been performed without relief of symptoms

3 This disease, like mesenteric lymphadenitis, is probably due to a low grade infection of lymphatic system. Its etiology is unknown.

4 The symptoms depend upon the stage, the location, and the severity of the disease.

5 The important symptoms are pain, often severe and cramp like diarrhea, vomiting, fever and loss of weight. A mass may be palpated.

6 The disease may occur in either the small or large intestine but is most often observed in the terminal ileum.

7 Determination of the diagnosis depends upon the roentgenologist. A filling defect in the terminal ileum, distention proximal to the defect and the characteristic string sign are typical.

8 Pathological findings vary according to the stage of the disease. The thickened mesentery, enlarged glands and the hyperemic enlarged hose like intestine are typical.

9 Proper surgical treatment is still a question for discussion. In 2 cases in this series resection was performed and in another ileocolostomy with equally satisfactory results.

10 The type of operation to be performed depends upon the individual case. Resection is not advised in debilitated patients. In some cases entero anastomosis will not suffice and resection will be required to relieve symptoms.

BIBLIOGRAPHY

- BELL L P. Mesenteric lymphadenitis simulating an acute abdominal condition. *Surg. Gynec. & Obst.* 1922, 45, 465.
- BISSELL A D. Ulcerative ileitis. *Ann Surg.* 1934, 99, 957.
- BROWN I W, BARGEN J A and WEBER H M. Chronic inflammatory lesions of the small intestine (regional enteritis). *Am J Digest Dis.* 1934, 1, 426.
- CLUTE H M. Regional ileitis. *Surg. Clin. N. Amer.* 1933, 13, 561.
- COLEMAN EVERETT. Acute mesenteric lymphadenitis. *Tr. Western Surg. Ass.* 1934.
- COLP KALPH. A case of non specific granuloma of the terminal ileum and the cecum. *Surg. Clin. N. Amer.* 1934, 14, 443.
- CONNELL F C. Regional ileitis. *Am J Digest Dis.* 1936, 6, 438.
- CORE J PHILIP and BOECK WILLIAM. Chronic ulcerative enteritis. *Am J Digest Dis.* 1934, May.
- CROWN B B. Broadening conception of regional ileitis. *Am J Digest Dis.* 1934, 1, 9.
- CROWN B B, GINZBURG L, OPPENHEIMER S D. Regional ileitis. *J. Am. M. Ass.* 1932, 99, 1333.
- CROWN B and ROSENBAUM B D. A combined form of ileitis and colitis. *J. Am. M. Ass.* 1936, 106, 1.
- DE COURCY J L. Terminal ileitis simulating acute appendicitis. A case report. *J. Med.* 1934, 15, 216.
- DONCHES J C and WARREN SHIELDS. Chronic cicatrizing enteritis. *Arch. Path.* 1934, p. 23.
- FEBL L H and FARMER A W. Ileocolitis. *Surg. Gynec. & Obst.* 1933, 61, 6.
- FROHMAN J F and BLUNT C V. Non specific granuloma of the gastrointestinal tract. *Surg. Gynec. & Obst.* 1935, 57, 71.
- FELSEN J and CORENBERG H. Chronic dysentery distal ileitis and ulcerative colitis. *Am J Med Sc.* 1936, 192, 553.
- FISHER A W and LERMAN. Ueber eine tumorbildende ulcerosostenosierende und perforierende Entzündung des unteren Ileum. *Arch. f. klin. Chir.* 1933, 177, 638.
- FREEMAN LEONARD. Mesenteric lymphadenitis. *Tr. Western Surg. Ass.* 1922.
- GALAMOS A and MITTELMANN W. Typical and atypical terminal ileitis. *Am J Digest Dis.* 1935, 7, 442.
- GINSBURG L and OPPENHEIMER C D. Hypertrophic ulcerative stenosis of the terminal ileum, regional ileitis. *Am J Surg.* 1933, 98, 1050.
- HARRIS F L, BELL G H and BRUNN H. Chronic cicatrizing enteritis. *Surg. Gynec. & Obst.* 1933, 57, 637.
- HOLM C E. The fate of the sidetracked loop of ileum following lateral anastomosis for complete benign obstruction. *Surg. Gynec. & Obst.* 1935, 56, 746.
- HOMANS JOHN. Regional ileitis—a clinical not a pathological entity. *N. England J. Med.* 1933.
- JACKMAN W A. Localized hypertrophic enteritis as a cause of intestinal obstruction. *Brit. J. Surg.* 1934, 22, 2.
- KANTOR J L. Regional (terminal) ileitis its roentgen diagnosis. *J. Am. M. Ass.* 1934, 103, 2016.
- MOCK H. Infective granuloma, non specific chronic tumor like productive inflammations of gastrointestinal tract. *Surg. Gynec. & Obst.* 1931, 11, 672.
- MOSCHCOWITZ L and WILENSKY A. Non specific granuloma of the small intestine. *Am J Sc.* 1923, 166, 48, 1927, 175, 374.
- PALLSON MOSES. Distal or regional ileitis ulcerative enteritis not an entity. *Am J Digest Dis.* 1936, 6, 430.
- PHILLIPS K T. A case of regional ileitis. *N. England J. Med.* 1934, 211, 457.
- PROBSTEN J G and GREENFELD G E. Acute regional ileitis. *Ann Surg.* 1936, 103, 273-288.
- POWERS J H. Unusual inflammatory lesions of the ileocecal region. *Ann Surg.* 1936, 103, 279-289.
- REICHERT F L and MATHES M E. Experimental lymphedema of intestinal tract relation to regional cicatrizing enteritis. *Ann Surg.* 1936, 104, 601.
- ROCKEY F W. Thickening of the terminal ileum with mesenteric adenitis. *Northwest Med.* 1933, 32, 145.
- ROFAE W. Zur Kenntnis der tumorbildenden ulcerösen stenosierenden Entzündungen des unteren Ileums. *Zentralbl. f. Chir.* 1934, 61, 1568.
- STOLT FRANTZ, HOIGENSEN and SMITH. Regional ileitis. *Iresbyterian Hosp. Rep. N. Y.* 1934.
- SVABO K. Einiger ueber magen und Darmphlegmonen. *Zentralbl. f. Chir.* 1934, 61, 947.
- TAYLOR JUDSON L. Nonspecific granuloma of the gastro intestinal tract with report of two cases in the ileocecal region. *Texas J. Med.* 1936, 32, 334.
- TIEZTE Ergeben d. Chir. u. Orthop. 1920, 12, 212.
- WILENSKY A O and HARN L J. Mesenteric lymphadenitis. *Ann Surg.* 1926, 83, 812.

THE ADVANTAGES OF GRADUAL DECOMPRESSION FOLLOWING COMPLETE COMMON DUCT OBSTRUCTION

I S. RAVIDIN, M.D., I. A. C. S., and W. D. FRAZIER, M.D., Philadelphia, Pennsylvania

THE effects of the rapid release of increased intravisceral pressure in most of the systems of the body have been studied and described. Creevy stated that the Ebers *Papyrus* gives a method for preventing the too rapid withdrawal of urine from the distended urinary bladder. Although Creevy thought that the effects of sudden relief of the greatly distended bladder were overestimated, VanZwalenburg, Hirsch, Campbell, Bumpus and Foulds, and many others, believed that renal and circulatory collapse did at times follow sudden bladder and urinary tract decompression. Bumpus and Foulds stated that "if the chronically distended bladder is emptied rapidly and completely at one time, the sudden reduction of the intravesical pressure results in immediate congestion throughout the urinary tract with resulting edema and hemorrhage which may be so severe as completely to suppress renal function."

Plummer, Thorington and Schmidt, and others have studied the effect of increases in the abdominal pressure on the arterial and venous pressures. Brams, Katz and Kohn have reported on the effect of abdominal distention and release on the blood pressure in the carotid artery and the veins above and below the diaphragm. They observed that after the release of marked abdominal distention which had persisted for some time, the fall in arterial pressure was as much as 40 millimeters of mercury. They wisely cautioned that such a drop "in a feeble patient might result in death."

McLaughlin and Levering found that "the rapid release of the (greatly increased) intragastric pressure, even when this had been maintained for only a short period, resulted in profound changes in the arterial system."

Elman has reported on the acute crises that are observed in certain cases after the sudden release of a greatly distended intestine, especially the small bowel. This reaction simulated shock in many respects and a number of the cases cited progressed steadily to a fatal outcome. A precipitous fall in blood pressure has been noted in such cases. Aird has produced the same train of events in experiments designed to study the effect of rapid deflation of the distended bowel.

For some years we have been interested in the pathologic physiology of common bile duct obstruction. Certain of the changes which are observed once the common bile duct becomes obstructed are not unlike those observed after obstruction in other viscera. We wish to discuss certain of the changes incident to common bile duct obstruction together with what we believe to be a rational plan of management following removal of the obstruction.

Changes in the liver cells following common duct obstruction. When the common bile duct becomes obstructed the liver cells continue to secrete bile until the intraductal pressure reaches the secretory pressure of the liver. The time at which this suppression of secretory activity of the liver cells occurs depends in large part upon the state of the gall bladder at the time of the obstruction and the condition of the liver.

If the gall bladder is capable of absorption, bile may continue to be secreted for hours, while if the gall bladder is so damaged that absorption through its wall is no longer possible, or worse still, if it is so severely damaged that fluid pours into its lumen from the wall, the intraductal pressure may rise so abruptly that secretory suppression of the liver results within a very few hours.

The liver is at best an organ which cannot be rapidly distended to any great extent. The capsular covering of this organ does not so

From the Harrison Department of Surgical Research and the Department of Surgery, School of Medicine, University of Pennsylvania. Aided by a grant from the Josiah Macy Jr. Foundation.



Fig 1 Photomicrograph showing appearance of the normal liver $\times 90$



Fig 2 Photomicrograph showing areas of icterus necrosis and dilated biliary radicals and areas of marked degeneration of hepatic cells $\times 90$

readily accommodate itself to increases in intravisceral tension as do the hollow viscera. Furthermore when as a result of infection there exists considerable cirrhosis distention becomes more difficult and the problem even more critical.

The intrahepatic ducts dilate at the expense of the hepatic cells and blood vessels. The portal venous circulation suffers most. Normally the portal pressure is low and as the intraductal pressure increases the flow of portal venous blood through the liver is greatly retarded. There occurs portal venous stagnation which is reflected backward to the abdominal viscera whose venous return is through this system.

Many years ago Frerichs reported on the lesions of the liver cells which may be seen following portal venous obstruction. Eppinger has called attention to the areas of "icterus necrosis" and others have observed areas of such size as to call them "biliary infarcts." While some writers have believed that human bile is incapable of producing permanent hepatic cell injury, Rous and Larimore have stated that, "If this be true man differs from all other well studied animals." Figures 2 and 3 show a few of the changes in the cytology of the liver which occur shortly after obstruction of the common bile duct.

The portal circulation is not alone affected by the ductal occlusion but as the pent up

biliary and ductal secretion accumulates the arterial circulation suffers in a lesser degree. Nevertheless the combined effect is to provide a degree of hepatic anoxemia which as Rich has shown causes histologic changes in the hepatic cells.

The effect of portal venous stasis on the circulation. Since the portal venous system drains a large part of the blood from the abdominal viscera, obstruction to it has additional effects. The stagnation of blood in the intestinal tract and other viscera leads to an increase in the blood volume in this part of the circulatory system and a decrease in the circulating blood volume. The degree to which this may occur is in part dependent on the efficiency of the collateral venous anastomosis.

The bilious ascites that is so frequently observed in varying degrees following common duct obstruction is in part an expression of the rise in pressure in the capillaries. The circulation time through the capillaries is increased and there may result an excessive reduction of the oxygen content of the blood in this region of the vascular system. The accompanying anoxemia leads to an increased permeability of the capillary wall and causes an increased passage of fluid through it.

Decompression. While the obstruction of the common bile duct may in itself produce serious cytological changes in the liver and

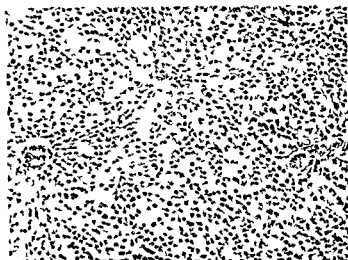


Fig 3 Photomicrograph showing the dilated biliary capillaries and marked passive congestion resulting from common duct obstruction $\times 80$



Fig 4 Intense hyperemia and the extravasation of blood into the biliary capillaries following the sudden release of complete common duct obstruction $\times 90$

physiological changes in the portal venous circulation, it is equally true that the rapid release of the obstruction with the sudden inflow of blood into hepatic vessels whose circulation was in varying degrees impeded may lead to equally serious consequences. The intense hyperemia which takes place when a complete ductal obstruction is suddenly released (Fig 4) may cause additional damage to the liver cells and changes in circulation.

The difference of opinion now expressed in the literature as to whether compression or decompression produces changes in the urinary tract may possibly be explained by the assumption that both processes produce cytologic and physiologic changes. Which one may cause the most marked alteration in function may in part be associated with the rapidity with which compression or decompression is accomplished.

Mont Reid, in discussing certain possible advantages of biliary decompression, stated

The effect of cysticocholedochostomy or some modification of it may afford a means of gradually releasing the bile pressure in the biliary apparatus.

I have frequently observed that the drainage of common bile duct of deeply jaundiced patients is followed by a serious toxic state characterized by listlessness, normal or subnormal temperature, and a tendency to sleep. I have not seen this toxic state in non jaundiced patients, and it would seem, therefore, to be due not merely to the loss of bile, but rather to the effect of the release of the bile pressure. The same effects have been noted when deeply jaundiced patients were relieved of their bile

pressure by anastomosing the gall bladder to the stomach or intestine.

In 1926, one of us (14) reported that he had used a method which provided for a type of gradual decompression and that he thought the matter should be further investigated. The problem, however, has received scant attention. For some years we have used the following method of decompression after the release of an obstructed common bile duct.

Method As soon as the T-tube has been sutured in the common duct and bile begins to flow from it, it is clamped. When the

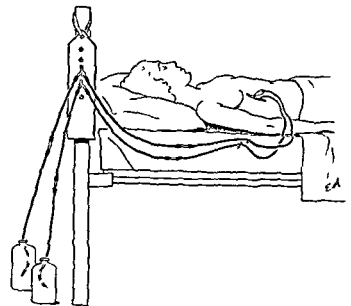


Fig 5 Diagram of decompression apparatus

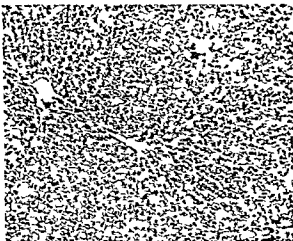


Fig 1 Photomicrograph showing appearance of the normal liver $\times 90$



Fig 2 Photomicrograph showing areas of icterus, necrosis and dilated biliary radicals and areas of marked degeneration of hepatic cells. $\times 90$

readily accommodate itself to increases in intravisceral tension as do the hollow viscera. Furthermore when as a result of infection there exists considerable cirrhosis distention becomes more difficult and the problem even more critical.

The intrahepatic ducts dilate at the expense of the hepatic cells and blood vessels. The portal venous circulation suffers most. Normally the portal pressure is low and as the intraductal pressure increases the flow of portal venous blood through the liver is greatly retarded. There occurs portal venous stagnation which is reflected backward to the abdominal viscera whose venous return is through this system.

Many years ago Frerichs reported on the lesions of the liver cells which may be seen following portal venous obstruction. Eppinger has called attention to the areas of 'icterus necrosis' and others have observed areas of such size as to call them 'biliary infarcts'. While some writers have believed that human bile is incapable of producing permanent hepatic cell injury, Rous and Larimore have stated that "If this be true man differs from all other well studied animals". Figures 2 and 3 show a few of the changes in the cytology of the liver which occur shortly after obstruction of the common bile duct.

The portal circulation is not alone affected by the ductal occlusion but as the pent up

biliary and ductal secretion accumulates the arterial circulation suffers in a lesser degree. Nevertheless, the combined effect is to provide a degree of hepatic anoxemia which as Rich has shown, causes histologic changes in the hepatic cells.

The effect of portal venous stasis on the circulation. Since the portal venous system drains a large part of the blood from the abdominal viscera, obstruction to it has additional effects. The stagnation of blood in the intestinal tract and other viscera leads to an increase in the blood volume in this part of the circulatory system and a decrease in the circulating blood volume. The degree to which this may occur is in part dependent on the efficiency of the collateral venous anastomosis.

The bilious ascites that is so frequently observed in varying degrees following common duct obstruction is in part an expression of the rise in pressure in the capillaries. The circulation time through the capillaries is increased and there may result an excessive reduction of the oxygen content of the blood in this region of the vascular system. The accompanying anoxemia leads to an increased permeability of the capillary wall and causes an increased passage of fluid through it.

Decompression. While the obstruction of the common bile duct may in itself produce serious cytological changes in the liver and

readily be determined by frequent observations of the patient's stools and repeated van den Bergh determinations. In Figures 6, 7, 8, 9, and 10 are shown the variations in the bile drainage in a group of the patients on whom this apparatus has been used, when the level of the tube is moved up or down to maintain the conditions described above. The various levels are indicated by the numbers 1 to 5, 1 representing level of common duct and 5 a point about 25 centimeters above this.

Other advantages. While the advantages of gradual decompression of a chronically distended biliary ductal system must be clear from the cytologic and physiologic point of view, there are additional advantages of no mean importance. The forcing of bile into the duodenum, once the obstruction is relieved, which prevents the loss of bile to the exterior, is of great value.

It is only necessary that the pressure from the decompression apparatus be sufficient to overcome the tonus of the sphincter mechanism at the lower end of the common bile duct for the bile to flow freely into the duodenum.

Formerly the method of simply allowing the bile to drain into a bottle hung at the side of the bed exerted, if anything, a suction effect. In many cases this resulted in the drainage of large amounts of bile.

The loss of fluid and electrolytes when the bile is thus drained to the exterior is considerable, but of even more importance is the loss of the intestinal functions of the bile.

While the externally drained bile may be returned to the patient through a Jutte tube into the stomach, it is often impossible to administer all the bile drained externally by this method and the procedure is distasteful to the patient. In the method which we advocate the bile enters the duodenum by its normal route. Appetite improves rapidly and "pancreatic asthenia" has not been observed during convalescence.

SUMMARY

We have discussed the possible effects of obstruction of the common bile duct on the cytology of the liver cells and upon the portal blood flow. The effects of a rapid

release of complete common bile duct occlusion has also been discussed and a method presented for slowly decompressing the system after release of the obstruction. The method suggested obviates the necessity of feeding the patient bile during the post-operative period and results, we believe, in a smoother convalescence.

BIBLIOGRAPHY

1. AIRD, IAN. Effect on blood pressure of the sudden release of intestinal distention. *Proc Soc Exper Biol & Med* 1935 32 1593.
2. BRAMS, W. A. KATZ, L. N., and KOHN, N. The effect of abdominal distention and release on the blood pressure in the arteries and veins. *Am J Physiol*, 1933 104 120.
3. BUXFUS, A. C. and LOULDS, G. S. Gradual emptying of overdistended bladder. *J Am M Ass*, 1923 81 821.
4. CAMPBELL, A. F. Studies in bladder decompression. *J Urol*, 1927 17 371.
5. CREEL, C. D. Sudden decompression of the chronically distended bladder. *Arch Surg*, 1932 25 350.
6. LEMAY, R. Treatment of late acute intestinal obstruction. *Surg Gynec & Obst* 1933 56 175.
7. Idem. The danger of sudden distention of acutely distended bowel in late low intestinal obstruction. *Am J Surg*, 1934, 26 438.
8. FRIEDLÄNDER, H. Beiträge zur normalen und pathologischen Histologie des menschlichen Gallen capillaren. *Beitr z path Anat u z allg Path*, 1902 31 230.
9. Idem. Weitere Beiträge zur Pathogenese der Ikterus. *Beitr z path Anat u z allg Path*, 1903, 33 123.
10. FRERICHS, F. T. *Klinik der Leberkrankheiten*. Braunschweig, 1838 (Sydenham Society's Translation—A Clinical Treatise on Diseases of the Liver London 1861).
11. HIRSCH, L. W. Relation of bladder pressure to bladder function. *J Am M Ass*, 1928, 91 772.
12. McLAUGHLIN, C. W., JR., and LIVERING, J. W. The effects of increased intragastric pressure upon thoracic and abdominal arterial and venous pressures. *Surg Gynec & Obst*, 1934, 58 699.
13. PLUMIER, L. Etude expérimentale des variations de la pression veineuse. *Arch internat de physiol*, 1909, 8 1.
14. RAYDIN, I. S. Surgical problems of jaundice. *J Med Soc New Jersey*, 1926 23 341.
15. REID, MONT H. Drainage of common bile duct through cystic duct. *Ann Surg*, 1921, 73 458.
16. RICH, A. R. Pathogenesis of forms of jaundice. *Bull Johns Hopkins Hosp*, 1930 47 338.
17. ROUS, P., and LARMORE, L. D. The biliary factor in liver lesions. *J Exper Med*, 1920, 32 249.
18. SHAW, E. C. and YOUNG, H. H. Gradual decompression of chronic vesical distention. *J Urol*, 1924, 11 373.
19. THORINGTON, J. M., and SCHMIDT, C. F. Urinary output and blood pressure changes resulting in experimental ascites. *Am J M Sc*, 1923, 165 880.
20. VAN ZWALLENBURG, C. Emptying a chronically distended bladder. *J Am M Ass*, 1920, 75 1711.

THE DISRUPTION OF ABDOMINAL WOUNDS

A Report of 22 Cases

FRANK GLENN MD FACS and S W MOORE, MD New York New York

A COMPLICATION of abdominal surgery with which every surgeon is familiar is the disruption of wounds. That it is a serious accident is revealed by the mortality rate of 22 to 50 per cent, reported in a series of publications on the subject. This fact should stimulate surgeons to seek measures whereby such complications may be avoided.

The wisest attack upon the problem would seem to be a study of the incidence, etiology, and treatment of eversion. That effort has been expended in this direction is indicated by a growing literature many papers having been written by surgeons with wide experience. However it is difficult from these papers to obtain accurate information regarding the frequency of eversion, for few

From the Department of Surgery of the New York Hospital
and Cornell Medical College

authors state what percentage of their abdominal wounds broke down. Accurate data, also, are lacking concerning the use of different suture materials in large series of cases, and there are conflicting opinions regarding etiology and treatment of disruption of wounds.

Several variable factors must be considered in regard to every abdominal wound such as the location of the incision, the suture material used in closing, the operation performed, the lesion whether malignant or non malignant and whether infection was present previous to operation or introduced during the operative procedure.

For the purpose of making a comprehensive study of the problem of evisceration on the surgical service of the New York Hospital the records of all patients upon whom abdominal operations were performed between September 1, 1932, and April 30, 1936, were reviewed with respect to the factors named. It is believed that by this means all cases of disruption were brought to light and the fullest possible data obtained on them. A total of 2,927 records was reviewed and the data classified, 22 cases of evisceration were disclosed—an incidence of 0.75 per cent. The results of the study are shown in a series of tables.

The literature on disruption of wounds will be referred to only in making comparisons. Excellent reviews of the subject have been made by Jenkins and others.

ANALYSIS OF 2,927 ABDOMINAL OPERATIONS

In order to establish correct figures for the incidence of evisceration and for certain factors which may affect it, it obviously is necessary to know facts, not only concerning the cases of disruption, but concerning the series from which these cases were drawn. To obtain this information, a careful analysis of the 2,927 abdominal operations was undertaken

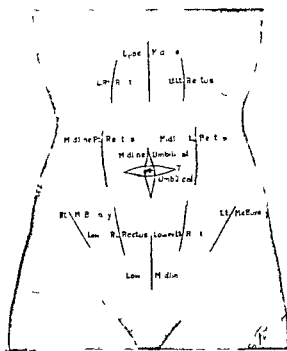


Fig 1 Location and designation of incisions employed.

TABLE I—GENERAL INFORMATION

Number of abdominal operations	2,927
Total eviscerations	22
Incidence, per cent	0.75
Deaths	10
Mortality, per cent	45.45*

*The 10 deaths due to evisceration accounted for 0.34 per cent of the total mortality for all abdominal operations

It was found that record room files, operating room cards, and operative notes on each case had to be consulted to complete the study. Table I shows the general information obtained.

A table was compiled to show the influence upon the incidence of evisceration of the site of the incision (Fig. 1), and it includes figures regarding the suture material used in closing each type of wound (Table II).

Tables III A and B approach the subject from a different viewpoint. Here the figures are given for incidence of evisceration in various operations and again reference is made to the suture material employed.

It will be noted that catgut was used in closing 1,608 wounds, silk sutures in 1,144, and silver wire in 175 cases. For the sake of clarity, a brief description of the suture materials and methods and the terminology applied to them will here be given.

I CATGUT CLOSURE

a Interrupted catgut closure The peritoneum is closed with a continuous suture of Zero plain or No. 1-20 day chromic catgut. The fascia is approximated by a series of interrupted sutures of chromic catgut No. 1. Stay sutures of silkworm or "Dermo" are placed so that they embrace the fascia only.

b Interrupted catgut closure with figure of 8 sutures This is a modification of *a*, instead of interrupted chromic sutures, the figure of 8 type of suture with No. 1-20 day chromic is employed.

c Interrupted catgut closure with drainage No. 1-20 day chromic catgut is used to close the peritoneum. Instead of one continuous suture, one continuous suture starts from each extremity of the wound and is brought to the point where the drain emerges. At this point on either side of the drain, a single reinforcing suture of the same material is placed. The single suture is referred to as a "safety suture." The fascia is closed in the manner described and stay sutures complete the closure.

II SILK CLOSURE

a Silk closure without drainage A continuous suture of twisted surgical silk No. 7 approximates the peritoneum and interrupted sutures of the same

TABLE II—SITE OF INCISION, SUTURE MATERIAL

Incision	Cat gut	Silk	Silver wire	Total	Eviscerations	Per cent
Upper right rectus	630	287	120	1,037	13	1.21
Upper left rectus	43	46	17	105	2	1.90
Lower right rectus	270	69	14	353	2	0.55
Lower left rectus	84	24	11	119	2	1.68
McBurney right	488	600	1	1,088	1	0.09
McBurney left	6	0	0	6	0	
Upper midline	1	16	1	18	0	
Lower midline	42	29	5	76	0	
Mid midline	4	35	0	39	0	
Mid right rectus	16	14	5	35	0	
Mid left rectus	5	1	1	7	1	14.00
Paracostal	9	2	0	11	0	
Transverse rectus	1	0	0	1	1	100.00
Transverse umbilical	1	11	0	13	0	
Totals	1,608	1,144	175	2,927	22	0.75

TABLE III A—OPERATION, SUTURE MATERIAL

Operation	Cat gut	Silk	Silver wire	Total	Eviscerations	Per cent
Appendectomy	671	626	6	1,303	1	0.07
Biliary tract operations*	414	131	52	597	8	1.34
Stomach operations	168	75	63	306	4	1.30
Small bowel operations	50	14	14	78	1	1.28
Large bowel operations	123	81	21	225	5	2.22
Pelvic operations	113	29	2	144	0	0
Exploratory laparotomy	20	20	4	44	1	2.27
Ventral hernia repair	24	125	1	150	2	1.33
Splenectomy	7	23	2	32	0	0
Miscellaneous	18	17	10	45	0	0
Total	1,608	1,144	175	2,927	22	0.75

TABLE III B—SUTURE MATERIAL, SUMMARY

Suture material	Total	Eviscerations	Per cent
Catgut	1,608	11	0.67
Silk	1,144	7	0.61
Silver wire	175	3	1.71

*One disrupted wound was closed with through and through silkworm gut

material unite the fascia. When stay sutures are employed they are of the same silk and form a lateral figure of 8, including the fascia. The subcutaneous tissues and skin are closed with interrupted silk (No. 5) sutures.

b Silk closure with drainage This closure is the same as *b* above except that silk, No. 7, is used in place of catgut. The safety sutures of silk are employed. Stay sutures may or may not be used, the subcutaneous tissues are not approximated unless they are unusually thick. Ordinarily the deep skin sutures (No. 5 silk) suffice to bring these tissues into approximation and reaction around the drain is less likely to persist in the surrounding tissues if sutures are omitted.

III SILVER WIRE CLOSURE

Through and through silver wire closure. A suture of silver wire is introduced from the skin through the subcutaneous tissues and fascia down to and through the peritoneum and is then returned to the skin layer by layer. Silver wire sutures should be placed not more than 3 centimeters apart. When they have all been placed, they are drawn tight and each one is secured separately by twisting. No guards to protect the skin from the wires are employed. The wire is No. 20 round silver wire.

It may be said that considerable latitude is granted the members of the surgical service of the New York Hospital in the selection of suture material and slight modifications in procedure also are noted. It is the opinion of the authors that, to prevent evisceration, the safest closure is the through and through silver wire method developed and popularized by French surgeons and more recently described by Reid *et al*. In this series 175 abdominal wounds were closed in this manner. Without exception these were cases in which it was felt that disruption was most likely to occur, i.e. in individuals with massive abdominal infections, with extremely obese abdominal walls, with poor musculature, or else in debilitated patients suffering from malignant disease. In the analysis of cases, three disruptions are credited to silver wire closure, but in none of these was the method at fault. In one the wire broke because it was of smaller caliber than usually employed, hence, the evisceration was due to material rather than procedure. The wires in another patient were not twisted enough to resist the pressure exerted by a muscular abdomen under tension. In a third case all wires were removed at one time which is contrary to the prescribed procedure.

In the group of disrupted wounds, the secondary closure was accomplished with silver wire in all but 4 cases. It is worthy of

note that not one of the secondary closures broke down, a further evidence of the efficiency of this method of closing. It is recommended, therefore, that silver wire closure be used in the presence of massive abdominal infection, in wounds which have been grossly contaminated by gastro intestinal contents, and in all patients debilitated by malignancy, or long standing chronic disease associated with anemia. In other types of cases silver wire closure is not indicated nor is this method of closure required.

There are definite rules and requirements which must be met in the use of silver wire. (1) The several layers of the abdomen must be carefully approximated to avoid massive scar formation, which may be a potential factor in postoperative weakness of the abdominal wall. (2) The wires must be placed with meticulous care to prevent the inclusion of a segment of intestine or omentum in the concealed loop of silver wire as it is drawn tight. Reid *et al* report 334 cases closed with through and through silver wire without a disruption, but they cite several instances in which a loop of bowel or omentum protruded between two wire sutures. Such instances in our series have been included in the eviscerations. (3) Gauge 20 round silver wire should be used. It has been found that this size wire, as furnished by a number of manufacturers, possesses sufficient tensile strength to maintain any abdominal wound in proper approximation, provided the sutures are placed not more than 3 centimeters apart. Wire of smaller caliber, though it may be equally strong, has a greater tendency to cut through the edges of the wound. (4) Guards between the silver wires and the skin are not employed, for it has been found that a greater degree of necrosis results when such protective agents are used. (5) The sutures should be removed one a day after the fourteenth or fifteenth days. (6) Before removal, the silver wire and skin should be disinfected, for it is obvious that otherwise infection might be carried by them into the peritoneal cavity. (7) Continuous buried metallic sutures are not advocated in abdominal closures, for reaction to a foreign body over a long period of time may lead to abscess formation.

One definite disadvantage in the use of silver wire in closure, is in connection with drainage, for, on account of its bulk, it diminishes the space through which the wound is drained.

In a closer study of these abdominal operations in regard to evisceration, little difference will be noted in the results of silk and catgut closures. However, it is the opinion of the authors that if silk were used with proper discrimination, the results with it would be better than those with catgut. The suitable cases for silk sutures are without gross infection. In the presence of infection, a catgut closure is preferable. It is employed in the majority of abdominal closures here as elsewhere in this country. Though the authors have no positive convictions concerning the comparative value of silk and catgut, they are convinced that both should never be used in the same wound. When used alone in a clean wound there is no reaction around silk sutures. Some reaction takes place as catgut sutures are absorbed. The exudation of white cells and serum around the catgut sutures may invade the region of the silk sutures, which then become foreign bodies. A "sterile abscess" may result and there is induration and tenderness until the silk suture is cast out of the wound. The injudicious use of these two suture materials in the same wound has cast discredit upon silk sutures.

Table IV shows the effect on the incidence of evisceration of malignancy. It also indicates the seriousness of this accident in malignant cases, for the mortality will be seen to be more than twice as high after operations for malignant conditions than for non-malignant conditions.

Certain facts are revealed by a study of the four tables thus far presented. In Table II it will be seen that mid left rectus and transverse rectus incisions are rightfully used with great reserve, for the incidence of evisceration

in both is very high. Of the usual incisions in the upper abdomen, the upper left rectus carries the highest percentage of disruptions in this series. Only one McBurney wound disrupted, in this case the closure was inadequate and the drains were of such bulk as to prevent the wound from closing. The high incidence of evisceration noted under "Large bowel" in Table III may be accounted for by the fact that many cases of carcinoma were included under this heading (198 out of 225). That malignancy very seriously affects the incidence and results of evisceration is shown in Table IV.

The data which have been tabulated and discussed so far have to do with evisceration in its relationship to the total number of abdominal operations. Table V concerns the cases of disruption. Each item in the table will be discussed briefly.

Unlike many reports on the subject of eviscerations, this report is marked by a preponderance of male patients (91 per cent). Melency and Howes report 70 per cent, Colp 54 per cent, and Maes 49 per cent males in their series. Although the exact figure is not available, men and women were about equally represented in the total abdominal operations.

The majority of patients whose wounds disrupted were between 40 and 60 years old. The youngest patient was 4 and the oldest 72 years of age.

Malignancy has been emphasized as a predisposing factor by many authors, that it acts in this capacity is demonstrated well in our series of cases. There were 6 eviscerations in patients operated upon for malignant disease, they comprised 27 per cent of the total eviscerations. In 582 laparotomies for malignancy, there were 6 eviscerations (1.20 per cent), in 2,345 operations for non-malignant diseases there were 16 eviscerations (0.67 per cent). Thus in this series, evisceration occurred twice as often in malignant diseases.

Of the 16 eviscerations in the non-malignant cases 6 followed cholecystectomies, 3 for acute and 3 for chronic cholecystitis. The 10 other eviscerations were associated with operations for the following conditions: peptic

TABLE IV.—EVISCEATION IN MALIGNANCY

	Malignant disease	Non malignant disease
Total cases	582	2,345
Eviscerations	6	16
Incidence, per cent	1.20	0.67
Mortality from eviscerations, per cent	83.33	31.25

TABLE V—CASES OF DISRUPTION—Continued

No.	Sex	Age	Diagnosis	R.H.C.H.G.R.	WBC	Dehiscence	Jaundice	Blood pressure	Arterio-sclerosis	Syphilis	Diabetes	Operation	End. suture	Suture material	Cigarette drains	Disrupted 1-10 days	Contributing factors	Secondary closure	Discharged P.O. days	Died P.O. days	Follow up	Hernias
3536	M	55	Ulcerative colitis	3 6	50	6 700	++	110	0	?	0	Mikulicz ileum	L.R.R.	Silk	0	1	Inadequate closure	Silk	5	5	Autopsy	None
9172	M	38	Postoperative ventral hernia	4 5	84	10 800	0	140	0	0	0	Repair of ventral hernia	U.R.R.	Silk	0	9	Unco-operative stool up	Sw	67			None
21970	M	33	Cholecystitis acute			9 500	0	105	0	0	0	Cholecystectomy	U.R.R.	Sw	3	3	Wire untwisted	Sw	37			None
31718	M	72	Gastric ulcer	4 0	70	6 000	++	110	sl	0	0	Posterior gastro-enterostomy	U.R.R.	Sw	0	16	Bronchitis sutures all over 10th day	Sw	3	3	Autopsy	None
26886	M	51	Gastric ulcer	4 1	70	9 000	++	110	0	0	0	Gastric resection partial	U.L.R.	Sw	0	10	Bronchitis broken wires	Sw	19		Seen after 2 yrs	None
51926	M	53	Carcinoma cecum	2 5	40	20 000	++	150	sl	0	0	Exploratory in carcinoma abdomen	U.R.R.	Silk	7	6	Infected wound Distention	Pack adh.	1	1	Autopsy	

ulcer, 3, postoperative hernia, 2, ulcerative colitis, 1, diverticulosis of the colon, 1, bleeding from the gastro-intestinal tract, 1, appendicitis with peritonitis, 1, and pancreatitis, 1.

Operations for malignant diseases and for disturbances of the biliary tract together were responsible for 12 eviscerations, 54.5 per cent of the total number.

Debility long has been recognized as a possible cause of evisceration. It was present as evidenced by loss of weight, anemia etc., in 11 of the 22 cases. As one might expect, it was confined largely to the patients with carcinoma, bleeding ulcer, or chronic debilitating diseases such as ulcerative colitis. The red blood cell counts ranged from 2.5 to 5.9 million and the hemoglobin from 40 to 106 per cent. In all but one of the patients classified as debilitated, the hemoglobin was below 80 per cent, while in all save one of the others it was above 80 per cent. However, these figures for hemoglobin fail to give a true index, for they represented the last count obtained before operation, after every means of raising the hemoglobin by transfusions etc., had been exhausted.

Although the blood pressure was slightly elevated in a few of the cases and definite arteriosclerosis was noted in 8, both were in keeping with the average for this age group.

This series of cases is remarkable because in no instance was jaundice or diabetes associated with the evisceration although these conditions have been encountered frequently in the surgical cases in this clinic.

There was one patient with a history of syphilis and a 4+ Wasserman reaction. In 2 others the serology was questionable. Aside from these, lues played no part.

It will be seen in Table V that evisceration occurred 13 times in upper right rectus incisions, twice in upper left rectus incisions, once in a transverse rectus incision, once in a mid left rectus, once in a McBurney, twice in lower left rectus, twice in lower right rectus incisions. It is interesting to note that the single transverse rectus incision disrupted 7 days after operation.

An attempt has been made to discover a connection between evisceration and the type of suture material used. Of the 22 eviscera-

tions 11 were in wounds closed with catgut, 7, with silk, 3, with through and through silver wire, and 1, with through and through silkworm gut

Drains were used in 8 cases, 5 of which were gall bladder operations, 1 an appendix, 1 a carcinoma of the large bowel with abscess, and 1 a ventral hernia. The 14 remaining were closed without drainage.

The disruption occurred from 1 to 16 days after operation, the majority on the fifth to eleventh days after operation.

Occupying prominent positions among contributing factors were vomiting, 8, coughing, 6, distention, 5, and lack of co-operation, 2. It is well known that patients with stormy postoperative courses complicated by distention and vomiting necessitating gastric lavage, and by bronchitis with cough, are more likely to eviscerate. At the same time we find eviscerations among patients who presented none of these postoperative complications.

Secondary closures were effected in 18 of 22 cases with through and through silver wire sutures. None of these reopened. In 2 cases the wounds were packed and strapped with adhesive, in the 2 remaining the wounds were resutured.

Following secondary closure the patients remained in the hospital from 19 to 26 days.

The immediate mortality in this group of cases was 10 in 22 cases, or 45.45 per cent. This death rate corresponds closely to figures reported by other authors. White records 16 deaths in 30 cases. Meleney and Howes, 22 deaths in 50 cases (55 per cent and 44 per cent, respectively). Of the 22 cases suffering disruption 40.9 per cent died within 7 days of the secondary closure. Four died within 24 hours, 1 on the second day, 1 on the third day, and 2 on the fifth postoperative days. One death occurred 7 days after the secondary closure. Without exception the evisceration was definitely the cause of the immediate death. The majority of the patients although failing to make the usual progress after operation, showed no definite failing until the wound

gave way. From that time on their course was invariably unfavorable.

A follow-up of the cases discharged from the hospital after the secondary closure, showed that 1 died 8 months later of cirrhosis of the liver and another 22 days later as the result of cancer. There are 2 patients with definite postoperative hernias occurring 11 and 18 months respectively after operation, whereas 6 are not found to have hernias on revisits 10 days to 2 years after discharge from the hospital.

CONCLUSIONS

It cannot be said that very definite conclusions have been reached by this study in regard to the problem of evisceration. In all probability, the solution of the problem rests not in any one factor but in a number of different ones. It is suggested by the review of cases that closure of the abdomen should be accomplished by means of silver wire through- and through sutures in a larger number of suitable cases. When malignancy is associated with infection, as in the resection of any portion of the gastrointestinal canal, silver wire would seem to be the suture material of choice.

All wounds which are grossly infected and in which silver wire closure is not indicated, should be closed with catgut. Silk sutures should be used in clean wounds only.

Silk and catgut should not be used in the same wound.

BIBLIOGRAPHY

1. COLP R. Disruption of abdominal wounds. *Ann Surg*, 1934, 99, 14-27.
2. JENKINS, HILGER P. Personal communication.
3. MAES U, BOYCE FITZHERBERT F and McPETERIDGE E. Postoperative evisceration. *Ann Surg*, 1934, 100, 668-682.
4. MELENEY F L and HOWES E L. The disruption of abdominal wounds with the protrusion of viscera. *Ann Surg*, 1934, 99, 5-13.
5. REID M, ZINNINGER M and MERRILL P. Closure of the abdomen with through and through silver wire sutures in cases of acute abdominal emergencies. *Ann Surg*, 1933, 98, 890-896.
6. WHITE W C. Disruption of abdominal wounds. *Ann Surg*, 1934, 99, 39-42.

ANALGESIA, ANESTHESIA AND THE NEWBORN INFANT

STEWART H. CLIFFORD, M.D., and FREDERICK C. IRVING, M.D., F.A.C.S.,
Boston, Massachusetts

PRESENT methods of obstetrical analgesia are not ideal in their effects upon the mother (2), and none is without some unfavorable influence upon the fetus. Although these methods are not perfect, certain of them do give as high as 84 per cent complete maternal amnesia. The ultimate fate of present methods of analgesia may well hinge on the price the infant must pay for the mother's comfort. Modern obstetrical analgesia is accomplished by the skilful blending of various agents—thus pentobarbital, scopolamine, rectal ether and nitrous oxide-oxygen-ether may all be combined during one method of analgesia. The present study is a critical analysis of the influence of the various combined methods of analgesia and of their component parts upon the condition of the infant at birth.

A multitude of factors contribute to the condition in which the infant is found at birth (Chart 1). That the influence of analgesia or anesthesia may be determined, as many as possible of the other complicating influences must necessarily be eliminated or controlled. To this end the effect of various methods of analgesia has been observed in comparable groups (Table I) of normally delivered, full term, vertex presentation infants. All cases of operative delivery, breech extraction, internal podalic version, premature separation of the placenta, placenta praevia or congenital abnormality of the fetus have been excluded from this investigation. With the exception of the control group that received no medication of any kind, every case received nitrous oxide-oxygen, with or without less than an ounce of ether, for an average of 30 minutes and one of the basic analgesics.

This is the eighth in a series of studies of the newborn infant death rate from the Boston Lying in Hospital. The Departments of Obstetrics and Pediatrics of the Harvard Medical School and the Department of Child Hygiene of the Harvard School of Public Health. This study was made possible through the generosity of Mrs. Albert C. Burrage.

PHYSIOLOGY

The normal physiology of the fetus and the newborn. The effect of analgesia and anesthesia upon the fetus and the newborn must be expressed in terms of the observed variation from the expected normal behavior. This being the case, the normal physiology of the fetus and the newborn is reviewed briefly so that the findings of this study may be more intelligible.

The animal and, we believe, the human fetus make rhythmical respiratory movements *in utero* (7). When the fetus is removed from the fluid medium the established respiratory rate continues and the animal "breathes and develops quite normally" (5). This conception is quite different from the belief previously held that the respiratory mechanism lies dormant *in utero* and at birth some physical or chemical stimulus is required to initiate the first respiration.

The full term human fetus *in utero* exists normally in a state of cyanosis with a mean capillary oxygen unsaturation of 11.1 volumes per cent (3) (the threshold for visible cyanosis being at 6.5 volumes per cent). The normal fetus at birth, due to impairment of placental circulation by the retracting uterus, is in an even greater state of cyanosis with a capillary unsaturation of 13.9 volumes per cent. At birth the arterial blood of the fetus contains less oxygen than the blood in the maternal arm vein.

The normal fetus, therefore, exists *in utero* with a low oxygen content in its blood and in a constant state of cyanosis. This cyanosis becomes most marked at the moment of birth. Cyanosis must be considered the normal state for the infant at delivery and becomes pathological only if unduly prolonged. The normal fetus makes rhythmical respiratory movements *in utero* and, coincident with the termination of placental circulation at birth, we expect the normal infant to continue

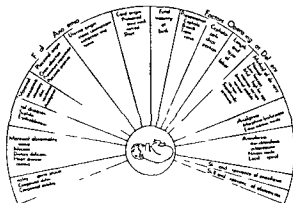


Chart 1 Factors influencing the condition of the infant at birth

this respiratory rhythm spontaneously as extra uterine breathing. In the present study an infant who fulfills the requirements of this paragraph is placed under the classification of "physiologically normal at the time of delivery."

The abnormal physiology of the fetus and the newborn. Intra uterine anoxemia of the human fetus whatever its cause, is accompanied by an accumulation of lactic acid in the fetal blood proportional to the degree of anoxemia (4). In extreme cases the amount of lactic acid accumulated may reach a point incompatible with life. In less severe degrees of anoxemia the respiratory rhythm of animal fetuses first become slowed and the heart rate is accelerated. In the presence of a

marked degree of anoxemia respirations stop, "the blood pressure slowly declines through 40 to 60 seconds. It then may show a slight increase, but finally falls rapidly through two to three minutes, then more slowly for one or two minutes until a systolic pressure of 15 to 20 millimeters mercury is reached. Concomitant with the drop in blood pressure the skin becomes blanched and cold, as in a shock."

If the fetuses are delivered at term under these circumstances, the onset of respiration either fails or is much delayed" (6).

Physical injury to the fetus, either through cerebral edema or hemorrhage, may affect the central nervous system centers directly and result in a clinical picture at birth much the same as that which is found in intra uterine anoxemia.

Certain drugs, such as ether, morphine, quinine, and the barbiturates, when administered in doses of sufficient amount to the pregnant animal will retard and at times arrest the respiratory movements of the fetus *in utero* (7).

The effect of abnormal factors may be evidenced by the death of the fetus *in utero* or at the time of delivery, by more or less difficulty in establishing the infant's extra uterine breathing and by an unusual prolongation of the cyanotic state of the newborn. They may be evidenced by a pallid state at the time of birth and by the absence of muscular tone.

TABLE I

Primary medication	Secondary medication	Cases	Vertical position	Normal deliveries %	Parity Av	Age Av	First stage av hrs	Second stage av hrs	Ruptured membranes to birth av hrs	Primary medication av gms	Scopolamine av gms	Rectal ether av oz	Gas oxygen av min	Ether av oz
None	None	53	100	100	5	30	10	2	3	0	0	0	0	0
Pentobarbital	Scopolamine	50	100	100	2.6	27	10	0.7	6	7.2	1/37	0	30	0.7
Pentobarbital	Rectal ether	50	100	100	2.4	26	13	0.0	5	7.0	0	2.7	27	0.3
Pentobarbital	Scopolamine, Rectal ether	35	100	100	1.7	27	18	1.5	9	8.1	1/118	2.1	30	0.8
Pentobarbital	Barbiturates	50	0	90	2.4	27				7.6	0	0	28	0.6
Sodium amytal	Scopolamine	0	100	100	2.5	28	13	0.7	6	11.8	1/50	0	26	0.8
Sodium amytal	Rectal ether	5	100	100	2.5	28	11	0.6	4	12.3	0	2.8	24	1.1
Perniton		5	100	100	2.5	27	15				0	0	26	0.3
Fa-topon	Scopolamine	50	100	100	2.8	27	15	0.7	5	1/3	1/43	0	27	1.0
Pantopon	Rectal ether	25	100	100	2.6	26				/	0	2.5	24	1.1
Morphine	Magnesium sulfate	25	100	100	3.0	26	15	0.6	5	3/	0	0	29	1.0

THE EFFECT OF OBSTETRICAL ANALGESIA OR ANESTHESIA UPON THE LIFE OF THE FETUS AND NEWBORN

Obstetrical analgesia or anesthesia by means of a combination of pentobarbital or sodium amylal with terminal nitrous oxide-oxygen or nitrous oxide-oxygen-ether inhalation has been used with increasing frequency at the Boston Lying-in Hospital since 1931. Up to 1933 sodium amylal was in use but since this time practically every routine hospital delivery has received pentobarbital with or without scopolamine or rectal ether.

With this extensive use of the barbiturates, any fatal effect of the drug would have to be reflected in an increased stillbirth and neonatal mortality rate. These rates for a 5-year period preceding and for a like period following the introduction of barbiturate analgesia in 1931 are given in Chart 2. The stillbirth rate has fallen from 65 in the prebarbiturate era to 56 per 1000 births for the past 5 years. The neonatal mortality rate was 22 for the period prior to 1931 and 19 per 1000 births for the 5 years following.¹ It would appear from these figures that the general use of sodium amylal and pentobarbital in this clinic has had no ill effect on the life of either the fetus or the newborn infant.

In contrast to the statement just made, we issue a warning against the use of any analgesic containing an opium derivative. The only 2 deaths encountered in the 410 cases comprising this study occurred in the 75 receiving pantopon. Evidence that is to follow will demonstrate the alarming symptoms that have followed the use of morphine or pantopon. In a previous communication (1) it was

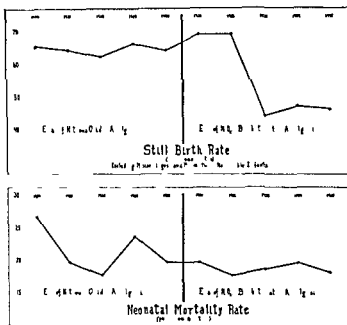


Chart 2

shown that the use of morphine within 4 hours of the birth of a premature infant was associated with a doubling of the death rate. It was also demonstrated that the larger the dose of the drug the higher was the associated mortality. In view of these facts one can but assume that the use of this type of analgesia on a large scale would result in an increase in the stillbirth rate and as well the neonatal mortality rate.

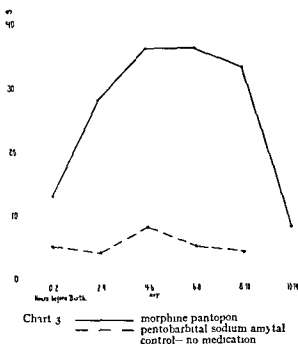
MORPHINE AND PANTOPON VERSUS SODIUM AMYAL AND PENTOBARBITAL—TABLE II

A Their relative efficiency as maternal analgesics and their effect upon the normal physiology of the newborn. Of the mothers receiving sodium amylal or pentobarbital as a basic analgesia 78 per cent had absolutely no memory of their labor compared with 34 per cent of those receiving morphine or pantopon.

TABLE II

	No anesthesia	Pentobarbital sodium amylal	Morphine pantopon
Cases	53	260	100
Type of labor			
Easy—per cent		78	34
Moderately easy—per cent		13	24
Moderately hard—per cent		5	24
Hard—per cent		4	18
Condition of infant at birth			
Physiologically normal—per cent	73	63	43
Active resuscitation required—per cent	0	3	23
Abnormal cyanosis—per cent	23	23	38

¹May 26 1937 The neonatal mortality for the year 1936 was 13 per 1000 births.



In the pentobarbital sodium amytal group, 63 per cent of the infants were physiologically normal at birth as opposed to 43 per cent of the morphine pantopon series.

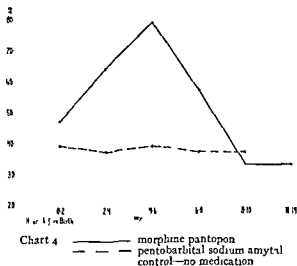
An active method of resuscitation, such as tubbing, mouth to mouth, or the use of a respirator, was required for 3 per cent of the barbiturate group and for 23 per cent of the morphine pantopon cases.

Abnormally prolonged cyanosis was present in 23 per cent of those receiving barbiturates and in 35 per cent of those given an opiate.

Two infant deaths occurred in the pantopon series and none in the barbiturate.

B The relation between the time interval from medication to birth and the condition of the infant at delivery (Chart 3) In an effort to detect the slightest effect of medication upon the fetus every case in which extra uterine respiration did not begin spontaneously and independently at birth has been classified as physiologically abnormal. This definition has been so rigidly applied that resuscitation by such simple means as suction and spanking has been sufficient to exclude the infant from the normal group.

In the case of morphine and pantopon a definite relation exists between the time inter-



val from medication to birth and the number of physiologically abnormal infants at delivery (Chart 3). Medication given to the mother less than 2 hours before birth is associated with some degree of abnormality in 47 per cent of the infants. This latter figure increases to a peak of 79 per cent abnormality in the group receiving medication 4 to 6 hours prior to the time of birth and then falls to 33 per cent when the time interval becomes 8 hours or more.

This relationship does not exist in the case of sodium amytal or pentobarbital medication (Chart 3). The rate of physiologically abnormal infants is fixed between 37 and 39 per cent whether the drug is given 2 or 10 hours before actual birth.

The more usual method of appraising the effect of maternal medication upon the fetus is to record the number of infants requiring active and vigorous methods of resuscitation (Chart 4). Again a definite relation is found to exist between the time of medication with morphine or pantopon and the number of infants requiring resuscitation by methods of artificial respiration. Thirteen per cent of infants whose mothers received morphine or pantopon within 2 hours of their birth required artificial respiration. Thirty six per cent required active resuscitation when the drug was given 4 to 8 hours before delivery and 8 per cent when medication was 10 hours or more before birth.

Again it should be emphasized that no relation between the time of medication and the incidence of cases requiring artificial resuscitation could be demonstrated in the case of analgesia with the barbiturates

C The relation between the size of the dose and the condition of the infant at birth The relation between the size of the dose of morphine or pantopon and the condition of the infant at birth cannot be determined from the present study since each patient received the same dose, $\frac{1}{3}$ grain of pantopon or $\frac{1}{4}$ grain of morphine sulphate, and in no case was the dose repeated. From an earlier study it was found that the premature infants of mothers receiving morphine within 4 hours of delivery encountered twice the death rate of infants whose mothers had not received the drug (1). It was also shown that the death rate increased as the size of the maternal dose increased.

The average pentobarbital medication in the present study was 7.5 grains. Of the group receiving 6 grains or less, 40 per cent of the infants were considered physiologically abnormal compared with 39 per cent of the group receiving 9 grains or more.

The average sodium amytal dosage was $12\frac{1}{2}$ grains. Of the group receiving 9 grains or less 36 per cent were thought to show some variation from the normal whereas in the series receiving 15 grains or more 32 per cent failed to breathe spontaneously the moment delivered.

A definite relation is thought to exist between the size of the dose of morphine administered and the condition of the infant at birth, but no relation is demonstrable be-

TABLE III—COMPARISON OF MORPHINE-PANTOPON AND BARBITURATE ANESTHESIA

	Morphine pantopon	Barbiturate
Complete maternal amnesia	34%	78%
Deaths in this series	2	0
Artificial resuscitation required	23%	3%
Infants physiologically normal at birth	43%	63%
Does a definite relation exist between time of medication and condition of infant?	Yes	No
Does a definite relation exist between size of dose and condition of infant?	Yes	No

tween the size of the barbiturate dose and the state of the newborn.

A review of the case of morphine-pantopon vs. barbiturate basic analgesia recalls the points as given in Table III.

In the light of these facts the use of morphine or pantopon as a method of obstetrical analgesia would appear to be not only unsatisfactory for the mother but dangerous to the infant.

THE COMBINATION OF SCOPOLAMINE, RECTAL ETHER OR PARALDEHYDE WITH THE BARBITURATES

The effect of combining scopolamine, rectal ether, or paraldehyde with the basic pentobarbital or sodium amytal analgesia has been analyzed in Table IV. When scopolamine is combined with either pentobarbital or sodium amytal a more successful obstetrical analgesia results in so far as complete maternal amnesia is concerned. The addition of this drug has not resulted in any significant change in the condition of the infants at birth. However, the combination of rectal ether or paraldehyde with the basic analgesia cannot be demonstrated to exert an unfavorable influence upon

TABLE IV

Basic analgesia	Secondary analgesia	Maternal amnesia %	Infant				
			Normal at birth %	Artificially resuscitated %	Abnormally cyanotic %	Minutes to first breath	Minutes to first cry
None (Control series)	None	0	73	0	23	1	2
Pentobarbital	Scopolamine	60	62	2	6	0.8	4.0
	Rectal ether	78	55	2	22	0.8	4.9
	Scopolamine rectal ether	83	69	3	15	0.5	3.0
	Paraldehyde	60	64	4	24	0.6	4.0
Sodium amytal	Scopolamine	82	58	8	26	0.8	3.0
	Rectal ether	72	70	0	26	0.5	4.4
Pernecton	None	44	66	6	40	0.7	5.4

the condition of the infant at birth, such addition does not result in a more successful maternal analgesia

PERNOCTON ANALGESIA

Pernocton (Table IV) was used intravenously in 50 cases but did not produce as successful maternal amnesia as did pentobarbital or sodium amylal. The infants under this medication reacted about the same as those under the oral barbiturates with the exception that more abnormal cyanosis was encountered

THE EFFECT OF NITROUS OXIDE AND ETHER UPON THE NEWBORN INFANT

In this study every case, except the controls, received nitrous oxide and oxygen during the second stage of labor (Table I)—the average length of administration being 30 minutes. Of the patients receiving gas oxygen for 30 minutes, 63 per cent of the infants breathed spontaneously on delivery, the series receiving gas oxygen from 30 to 60 minutes had 62 per cent normal infants while those from 60 to 120 minutes are recorded as having 63 per cent infants unaffected. In other words, the length of administration of nitrous oxide analgesia seems to bear no relation to the condition in which the infant is found at birth. Unfortunately, the concentrations of nitrous oxide and oxygen administered to the individual have not been recorded and the relation of this important factor to the infant's condition cannot be given from our material. The conclusions of Fastman (6) on this subject are important. "Nitrous oxide mixtures, administered to mothers in proportions of 85:15 or weaker, and for periods of less than 5 minutes, regularly cause moderate degrees of fetal anoxemia but the normal, full term infant is apparently not harmed. When nitrous oxide oxygen is given in concentrations of 90:10 or stronger over periods which exceed 5 minutes, marked degrees of fetal anoxemia are produced in about one baby out of three and occasionally profound asphyxia neonatorum results."

The average patient in our study received less than 1 ounce of ether combined with the nitrous oxide oxygen mixture (Table I). One hundred and two patients received no ether

and 57 per cent of their infants were classified as physiologically normal at birth. One hundred and eighty three received ether mixed with gas-oxygen and 66 per cent of their infants were entirely normal at birth. This small amount of ether certainly exerted no harmful effect on the fetus.

ANALGESIA VERSUS NO ANALGESIA

Since we believe analgesia containing an opium derivative should not be used the basic question resolves itself into barbiturate analgesia versus no analgesia. We have found little to choose between sodium amylal and pentobarbital but since the latter seems to be safer for the mother and to have slightly less effect on the baby it is the one in general use in our clinic. The comparison, therefore, is to be between delivery without analgesia and delivery under the combination of pentobarbital, scopolamine, rectal ether, nitrous oxide, oxygen, ether. The effects of these two systems, in so far as statistics can give them, are compared in Table V.

TABLE V

	No analgesia	Pentobarbital scopolamine rectal ether nitrous oxide oxygen analgesia
Maternal amnesia	0	84%
Fetal mortality	0	0
Neonatal mortality	0	0
Infants physiologically normal	73%	66%
Infants artificially resuscitated	0	2%
Infants abnormally cyanotic	23%	21%
Minutes to first breath	1 0	1 0
Minutes to first cry	1 6	4 7

What is indicated but not brought out already in this statistical comparison is the clinical fact that the analgesia baby is a dozey or sleepy baby. It is true that they usually gasp shortly after delivery but the respirations are shallow and frequently after the first breath a considerable period may elapse before normal respiration is established. Their muscles are relaxed and they are limp, as the Table V shows, an average of 5 minutes passes before they cry. An average of 2 per cent requires some method of artificial resuscitation before respiration becomes normal. As has been demonstrated by the fall in the stillbirth and neonatal mortality rates these symptoms,

while annoying or even alarming at times, are not serious—they are the price paid for analgesia. If analgesia is used, they must be expected, understood, and treated.

DISCUSSION OF THE FACTOR IN ANALGESIA RESPONSIBLE FOR THE SYMPTOMS OBSERVED IN THE NEWBORN

A Pentobarbital or sodium amytal We have been able to demonstrate no relationship between either the size of the dose or the time of administration of the barbiturates and the condition of the infant at birth.

B Scopolamine, rectal ether or paraldehyde We have been unable to prove an effect on the infants attributable to the doses used of scopolamine, rectal ether or paraldehyde.

C Inhalation ether The average patient having received less than 1 ounce of ether inhalation it is perhaps understandable that we have been able to show no effect on the infant.

D Nitrous oxide-oxygen There was no relation found between the duration of gas oxygen administration and the infant's condition.

As has been previously stated the factor about which we have had no information is the concentration of the nitrous oxide-oxygen mixture used. Eastman's demonstration that high concentrations of nitrous oxide will produce severe anoxemia of the fetus emphasizes the importance of this factor. He advises a mixture no greater than 85:15 even in operative obstetrics and the addition of ether to this mixture if necessary. With attention thus called to the marked influences on the fetus of high concentration of nitrous oxide, future experiences with analgesia may be more successful than that here recorded.

SUMMARY

Opium derivatives administered during labor have been found to exert an unfavorable influence upon the condition of the newborn infant proportional to the amount given and

to the time interval between the administration of the drug and the birth of the child. In this group 57 per cent of the infants required some stimulation before they would breathe and cry normally and 23 per cent were asphyxiated to the point of requiring artificial resuscitation. Successful maternal amnesia was obtained in but 34 per cent of the cases.

The barbiturates have had no harmful effect upon either the life of the fetus or upon the life of the newborn infant. Over 10,000 mothers have received sodium amytal or pentobarbital in the past 5 years, and during this interval both the still birth and the newborn infant death rates have fallen below the level of the preceding 5 years. Following analgesia through a combination of barbiturate, scopolamine, rectal ether, nitrous oxide-oxygen and small amounts of ether 37 per cent of the infants required some stimulation before normal respirations were established while 31 per cent were sufficiently asphyxiated to require artificial resuscitation. Complete amnesia was obtained for 78 per cent of the mothers in this group.

Neither pentobarbital, sodium amytal, scopolamine, rectal ether nor paraldehyde could be held responsible for the symptoms of asphyxia that were encountered in some of the newborn infants. It is our belief that the untoward effects of analgesia may well be explained by nitrous oxide-oxygen mixtures above the 85:15 level producing a degree of fetal asphyxia dependent upon the duration of the exposure and the size of the infant.

BIBLIOGRAPHY

1. CLIFFORD, S. H. *J. Pediat.*, 1934, 5, 2.
2. IRVING, I. C., BERMAN, S., and NELSON, H. B. *Surf., Gynec. & Obst.*, 1934, 58, 1.
3. EASTMAN, N. J. *Bull. Johns Hopkins Hosp.*, 1930, 47, 4.
4. *Ibid.* 1932, 50, 1.
5. *Idem*. *Anal. discussion*. *J. Pediat.*, 1936, 9, 2.
6. *Idem*. *Am. J. Obst. & Gynec.*, 1936, 34, 4.
7. SNYDER, F. I., and ROSENFELD, M. Quoted by J. Nathan, loc. cit.

PSEUDOMENSTRUATION IN THE HUMAN FEMALE

CHARLES MAZER, M D, F A C S, S LEON ISRAEL, A B, M D, and
LEON KACHER, A B, M D, Philadelphia, Pennsylvania

THE conception that normal menstruation is the result of rhythmic dismantling of an estrin primed and progestin-modified endometrium has not changed since the recognition of a correlation between the ovarian and endometrial cycles by Robert Schroeder (25) in 1913. Our newer knowledge of the physiology of menstruation has merely established the biochemical nature of the two ovarian hormones, estrin and progestin, which successively activate the endometrium in preparation for nidation of the fertilized ovum.

The immediate cause of the dismantling process of menstruation upon failure of fertilization is still conjectural. According to Allen, a decrease in estrin production resulting from the cyclic regression of the corpus luteum is the chief exciting factor of menstrual bleeding. This theory is strongly supported by the recent experimental observations of Smith on the effect of 10 daily injections of from 400 to 500 rat units of estrogenic substance in hypophysectomized rhesus monkeys. Uterine bleeding, indistinguishable from the normal anovular type, appeared in 8 of 10 test animals after withdrawal of the treatment. Two additional hypophysectomized animals, similarly treated with estrogenic substance and then given 2 rabbit units of progestin daily for a period of 10 days, menstruated from a progestational endometrium 3 days following the last injection. Since pituitary ablation invariably results in total suppression of ovarian function, Smith's recent work seems to indicate that withdrawal of estrin influence is the exciting if not the sole cause of menstrual bleeding and that the hormone, whether derived from the graafian follicle or corpus luteum, supplies the essential mechanism of the non secretory type of menstruation.

The ability of progestin to delay the onset of menstruation in normal and estrin treated

castrated rhesus monkeys (8) does not necessarily imply that the absence of the hormone, when the corpus luteum regresses, is the exciting cause of menstrual bleeding—no more than the ability of progestin to inhibit uterine motility (9) implies that the latter is caused by an absence of the hormone. Uterine motility, like uterine bleeding, is totally independent of progestin in its active phase.

In the human female, the individual and combined effects of the two ovarian hormones were amply demonstrated by Kaufmann, Claiberg, and others through the successive administration of estrogenic substance and progestin in castrated women. Estrin rebuilds the dismantled endometrium following menstruation, progestin modifies the estrin primed endometrium in anticipation of fertilization. In the absence of extreme uterine atrophy, uterine bleeding, clinically indistinguishable from normal menstruation, follows estrin treatment of castrated and menopausal women (5, 32).

Concerning the possible occurrence of rhythmic uterine bleeding, clinically indistinguishable from the normal, from an endometrium totally lacking the secretory (progestin) phase, Schroeder (27) states "There is a peculiar, seasonal phenomenon in apes (non ovulatory bleeding of Hartman) which has not yet been described in humans unless one accepts the cases recently reported by Mazer and Zisman. The report is not clinically convincing (lacks adequate description of the bleeding). However, a certain amount of evidence suggests that this may occur in human beings." Recognizing the justice of Schroeder's criticism, we have included in this study details unavoidably eliminated in the previous publication (20).

TERMINOLOGY PSEUDOMENSTRUATION VERSUS ANOVULAR MENSTRUATION

The somewhat acrimonious debate between English and American gynecologists concern

ing the occurrence or non-occurrence of cyclic and otherwise clinically typical menstruation from an endometrium lacking the secretory phase is founded mainly on the false premise that the phenomenon invariably connotes failure of ovulation and luteinization. Novak (23), for instance, states "Is there any way of determining whether or not a sterile woman is ovulating?" This question can be answered in the affirmative. The most direct and logical method is through study of the endometrium just before an expected menstrual flow, assuming that the periods recur regularly. If ovulation has occurred, the endometrium will show the characteristic secretory changes evoked by the corpus luteum hormone (progesterone). If, on the other hand, there is a complete absence of secretory changes, it may be assumed that there is no corpus luteum, i.e., that ovulation has not occurred." This statement is correct in its implication that the finding of a premenstrual endometrium justifies the assumption that ovulation and luteinization had taken place. It is unreasonable to assume, however, that the absence of the secretory phase in the endometrium obtained for examination premenstrually definitely indicates failure of ovulation and luteinization. Their absence in the human being may be suspected but cannot be proved without recourse to serial sections of both ovaries which are available in a normal state only in instances of accidental death during the premenstruum. Deductions drawn from autopsy or operative material are usually likewise inconclusive because the disease leading to the death of the patient or to a bilateral oophorectomy may have interfered with ovulation and luteinization. It will be shown later that, in the human female, factors other than failure of ovulation, such as an inherent or acquired lack of responsiveness of the endometrium or a quantitative disproportion of the two ovarian hormones, may enter into the etiology of this form of menstruation. Hence, the two terms, "anovular menstruation" and "pseudomenstruation," are not synonymous. When the diagnosis is based solely on endometrial findings, the term pseudomenstruation, originally suggested by Schroeder (26), is more appropriate.

TABLE 1—CONDITIONS WHICH LED TO VAGINAL OPERATIONS AND OPTIONAL CURETTAGE DURING THE PREMENSTRUUM IN 68 NORMALLY MENSTRUATING FERTILE WOMEN*

Indications for operation	Cases
Lacerations of birth canal	39
Prolapse of uterus	5
Dysmenorrhea	3
Retroversion of uterus	4
Cervical polyp	5
Chronic cervicitis	6
Pruritus vulvae	1
Uterine fibroids	1
Cervical malignancy	1
Renal calculus and rectocele	1
Chronic appendicitis	1
Hemorrhoids	1

Total number of cases 68

*All but 1 showed the premenstrual phase

THE INCIDENCE OF PSEUDOMENSTRUATION

The average cyclically menstruating woman of childbearing age shows a corpus luteum (secretory) phase in the endometrium after the sixteenth day of the beginning of her previous menstruation. We agree with Schroeder (27) that cyclic uterine bleeding at intervals of less than 21 days or a flow exceeding 8 days is evidently pathologic and is usually associated with follicle cystosis and endometrial hyperplasia.

That pseudomenstruation is rarely encountered in fertile or potentially fertile women is herein shown by a comparative study of endometrial tissues obtained by curettage premenstrually from 68 regularly menstruating fertile women in whom the procedure was optional and performed as a routine measure in the course of vaginal plastic operations (Table I). The patients ranged in age from 22 to 47 years with an average of 36.3 years. Each of them had borne 1 or more children, the average number was 3. The menstrual cycles of the 68 women ranged from 21 to 35 days, the average for the group was 29.8 days. The duration of the menstrual flow in these women varied from 3 to 7 days and averaged 5.4 days. Twelve of the 68 women (17.5 per cent) suffered from primary dysmenorrhea. The endometrial specimens from each of the 68 women were obtained from 2 to 7 days (average 4.7 days) prior to the expected menstruation. The endometria of all but 1 showed the secretory changes of the usual

premenstruum The remaining patient exhibited the phenomenon of pseudomenstruation. She was 36 years old and a mother of 4 children, the youngest of whom was then 9 years of age. She was voluntarily sterile since the last childbirth. Her menstrual periods were always regular, at intervals of 28 days, the flow lasting 3 days. She enjoyed good health but was annoyed by a relaxed vaginal canal for which a plastic operation was performed on April 24, 1933, when menstruation was just beginning. The endometrium recovered at the time of the operation was of the interval type, without the slightest evidence of progestin effect.

The contention of Shaw that the secretory phase is invariably present in the endometrium of women who menstruate cyclically and not excessively is based on a study of a relatively small group of patients, none of whom was within the scope of functionally sterile but otherwise normal women upon whom we made our previous and present observations. Some of his 28 patients whose time of the menstrual cycle permitted comparative study were sterile, but all of them had uterine fibroids and "myohyperplasia" to account for the existing sterility.

In 1932 the senior author in collaboration with Dr. Ziserman (20) reported on the occurrence of pseudomenstruation in nearly 50 per cent of 41 regularly menstruating women who were sterile without any discernible cause. This was the first detailed report in the literature on the absence of the secretory phase in a considerable number of regularly menstruating women. Passing mention of the condition in the human being was previously made by Corner in 1927, Mazer and Hoffman (17) in 1929 and by Novak in 1930. In 1934, Anspach reported that, in his experience, 9 of 42 regularly menstruating women treated for sterility, dysmenorrhea, and obesity showed no evidence of the secretory phase in endometria obtained premenstrually. In most instances of the Anspach series, the endometrium was definitely hyperplastic. In the same year, Tietze (30) found endometrial hyperplasia and absence of the secretory phase in 5 women who were menstruating at normal intervals and not excessively. In 1935 Jeffcoate re-

ported on the absence of the secretory phase in 10 of 21 cases of sterility "in the absence of any gross lesion or associated menstrual abnormality." In a few of these 10 patients he observed typical endometrial hyperplasia.

A more exhaustive study on the occurrence of pseudomenstruation in functionally sterile women was reported recently by Bland *et al*. Only 23 of their 50 regularly menstruating, functionally sterile patients, curetted premenstrually, showed the secretory phase. In 15 the endometrium was of the interval type, in 9 it was hyperplastic, and in the 3 remaining it was definitely atrophic. The studies of Anspach, Jeffcoate, and Bland, confined to the functionally sterile type of patients, confirm the original observations of Mazer and Ziserman on the high incidence of pseudomenstruation in regularly menstruating women who are sterile without an accountable cause other than an inadequate preparation of the endometrium.

One of us (11) has previously stressed the occasional presence of pseudomenstruation in patients suffering from primary dysmenorrhea. Recently Lackner and Krohn noted 4 instances of non secretory endometria in a group of 16 regularly menstruating women suffering from dysmenorrhea. It seems that during the developmental period of puberty and adolescence, pseudomenstruation is also frequently present, accounting for the relative infertility even of those of the exposed girls under 17 years of age who menstruate regularly (21).

ETIOLOGY OF PSEUDOMENSTRUATION

Three independent factors may produce pseudomenstruation, namely, failure of ovulation (anovulatory menstruation), an inherent or acquired lack of uterine responsiveness, or a quantitative disparity in production of the two ovarian hormones.

The presence of endometrial hyperplasia which occurs in one third of these patients points definitely to the first named etiological factor, namely, failure of ovulation and luteinization. This phenomenon is thus lucidly described by Tietze (31): "The human follicle persistence with subsequent endometrial hyperplasia may be a periodic occur-

rence I consider this a direct parallel to the non ovulating bleedings of monkeys (summer cycle). It is assumed that in the ovaries of such cases follicles periodically ripen and, in the absence of ovulation, produce follicular hormone over too long a period and then become atretic. The mechanism is similar to that of apes and guinea pigs—periodic excess of follicular hormone but without protracted follicle persistence as in women. The majority of such cases, usually presenting the quiet type of endometrial hyperplasia (i.e., simply an exaggerated proliferative phase), afford—some clinically, others anatomically—the deceptive information for menstruation without ovulation. In our opinion, this so called menstruation without ovulation is nothing more than bleeding from a pathologically proliferative endometrium. Anatomically the bleeding arises from a necrotic proliferative endometrium, but it is always a pathological proliferative endometrium. The connoisseur will recognize this. There are no grounds, at present, either to give up or to revise the well grounded conception of menstruation and the duality of the cycle. We agree with Tietze that histologically the condition connotes an abnormal form of menstruation and have, in fact, repeatedly emphasized its interference with the normal process of conception. Pseudomenstruation is, however, *clinically* indistinguishable from the normal type of menstruation because the rhythm and duration of the bleeding are basically normal.

The second factor operative in the causation of pseudomenstruation is a developmental or acquired uterine defect which prevents the organ from responding to normal ovarian activity. It is characterized by atrophy of the endometrium obtained premenstrually despite the presence of a normal level of estrogenic substance in the blood and urine. Patients with such a defect usually show a marked degree of uterine hypoplasia which occasionally responds to huge doses of estrogenic substance, given repeatedly 1 week of the month only, to avoid pituitary inhibition (18).

A striking illustration of a purely uterine defect in the etiology of pseudomenstruation and associated sterility is the following

F B, aged 30 years, who has been menstruating regularly and not excessively since the age of 11 had been sterile without an apparent cause for several years. Her uterus was small, hard, and retroverted and her adnexa neither palpable nor tender. The Rubin test showed patency of the fallopian tubes at a normal pressure and the Huehner test indicated normal insemination of the cervical canal. The unmodified Frank and Goldberger test was positive and her 24 hour output of urine yielded 13.3 rat units of active estrogenic substance, indicating a fairly good ovarian activity. A uterine curettage, performed at the Mt. Sinai Hospital under gas anesthesia on September 20, 1934, only 4 days before her expected flow, recovered only a few fibrous shreds (Fig. 1). She was given hypodermically 22,000 rat units of progynon B (dihydroxyestrin benzoate) in 3 divided doses during the early part of October. The following menstrual flow was profuse and appeared a week prematurely. We (19) have previously described this response of the uterus to relatively large doses of estrogenic substance. The patient was subsequently given 8,000 rat units of the same product in 4 divided doses and again curetted on November 7, 1934, 6 days before her expected flow. A considerable quantity of endometrium was obtained which on examination showed an early secretory phase with focal areas of hyperplasia (Fig. 2). She menstruated on time several days later and thereafter until March, 1935, when she conceived without additional treatment.

The presence of a marked uterine atrophy, despite a normal production of the follicular hormone, seems to point definitely to a uterine defect in the etiology of pseudomenstruation which, in this instance, was fortunately corrected by the administration of 2 courses of relatively large quantities of estrogenic substance. Inasmuch as the product does not stimulate the ovaries but exerts its influence on the muellerian tract, it is reasonable to assume that the pseudomenstruation and associated sterility were not due to failure of ovulation. We have seen instances of endometrial atrophy (in women suffering from primary amenorrhea and in castrates) in which the administration of as much as a half million rat units of estrogenic substance failed to produce the required endometrial growth preparatory to progestin administration by the Kaufmann technique.

The third probable cause of pseudomenstruation is a quantitative or qualitative disharmony between the two ovarian hormones, necessarily resulting in an inadequate preparation of the endometrium and suppression

premenstruum The remaining patient exhibited the phenomenon of pseudomenstruation. She was 36 years old and a mother of 4 children, the youngest of whom was then 9 years of age. She was voluntarily sterile since the last childbirth. Her menstrual periods were always regular, at intervals of 28 days, the flow lasting 3 days. She enjoyed good health but was annoyed by a relaxed vaginal canal for which a plastic operation was performed on April 24, 1933, when menstruation was just beginning. The endometrium recovered at the time of the operation was of the interval type without the slightest evidence of progestin effect.

The contention of Shaw that the secretory phase is invariably present in the endometrium of women who menstruate cyclically and not excessively is based on a study of a relatively small group of patients, none of whom was within the scope of functionally sterile but otherwise normal women upon whom we made our previous and present observations. Some of his 28 patients whose time of the menstrual cycle permitted comparative study were sterile, but all of them had uterine fibroids and "myohyperplasia" to account for the existing sterility.

In 1932 the senior author in collaboration with Dr. Ziserman (20) reported on the occurrence of pseudomenstruation in nearly 50 per cent of 41 regularly menstruating women who were sterile without any discernible cause. This was the first detailed report in the literature on the absence of the secretory phase in a considerable number of regularly menstruating women. Passing mention of the condition in the human being was previously made by Corner in 1927, Mazer and Hoffman (17) in 1929 and by Novak in 1930. In 1934 Anspach reported that, in his experience, 9 of 42 regularly menstruating women treated for sterility, dysmenorrhea, and obesity showed no evidence of the secretory phase in endometria obtained premenstrually. In most instances of the Anspach series the endometrium was definitely hyperplastic. In the same year, Tietze (30) found endometrial hyperplasia and absence of the secretory phase in 5 women who were menstruating at normal intervals and not excessively. In 1935, Jeffcoate re-

ported on the absence of the secretory phase in 10 of 21 cases of sterility "in the absence of any gross lesion or associated menstrual abnormality." In a few of these 10 patients he observed typical endometrial hyperplasia.

A more exhaustive study on the occurrence of pseudomenstruation in functionally sterile women was reported recently by Bland *et al*. Only 23 of their 50 regularly menstruating, functionally sterile patients, curetted premenstrually, showed the secretory phase. In 15 the endometrium was of the interval type, in 9 it was hyperplastic, and in the 3 remaining it was definitely atrophic. The studies of Anspach, Jeffcoate, and Bland, confined to the functionally sterile type of patients, confirm the original observations of Mazer and Ziserman on the high incidence of pseudomenstruation in regularly menstruating women who are sterile without an accountable cause other than an inadequate preparation of the endometrium.

One of us (11) has previously stressed the occasional presence of pseudomenstruation in patients suffering from primary dysmenorrhea. Recently Lackner and Krohn noted 4 instances of non secretory endometria in a group of 16 regularly menstruating women suffering from dysmenorrhea. It seems that during the developmental period of puberty and adolescence, pseudomenstruation is also frequently present, accounting for the relative infertility even of those of the exposed girls under 17 years of age who menstruate regularly (21).

ETIOLOGY OF PSEUDOMENSTRUATION

Three independent factors may produce pseudomenstruation, namely, failure of ovulation (anovulatory menstruation), an inherent or acquired lack of uterine responsiveness, or a quantitative disparity in production of the two ovarian hormones.

The presence of endometrial hyperplasia which occurs in one third of these patients points definitely to the first named etiological factor, namely, failure of ovulation and luteinization. This phenomenon is thus lucidly described by Tietze (31): "The human follicle-persistence with subsequent endometrial hyperplasia may be a periodic occur-



Fig 9



Fig 10



Fig 11



Fig 12

Figs 9 ($\times 60$), 10 ($\times 60$), 11 ($\times 65$) 12 ($\times 22$) Photomicrographs of specimens of endometrium obtained from regularly menstruating sterile women a few days before the

expected flow. All of these women have subsequently menstruated on time. Note especially the total absence of the secretory phase.

the subsequent menstrual flow. Six additional patients falling into the category of pseudomenstruation in sterile women are not included in this report because the expected flow failed to appear following the curettage. For the sake of accuracy, it was assumed that they would not menstruate on time irrespective of the operative interference. The endometria of 46 of the 65 women (70.8 per cent) showed the secretory changes of the pre-

menstrual period. However, in 8 of this group of 46, unmistakable areas of hyperplasia were present, indicating the presence of a disproportion between the two ovarian hormones (estrogenic substance dominance). The endometria of the 19 remaining patients of the group of 65 (29.2 per cent) showed no evidence of a secretory phase (pseudomenstruation), despite the fact that the expected menstruation occurred from 1 to 6 days following the

TABLE II—DATA RELATIVE TO 19 REGULARLY-MENSTRUATING, STERILE WOMEN WITH PSEUDOMENSTRUATION

Case No	Age	Menstrual history in relation to curettage				Histologic diagnosis of endometrium
		Type of cycle		Day of cycle when curetted	Day after curettage when period appeared	
		Days of bleeding	Days of complete cycle			
1	30	6	28	2	1	Hypoplasia
2	26	4	28	26	2	Hypoplasia
3	34	5	28	22	6	Hypoplasia
4	33	3-4	31	2	5	Hypoplasia
5	31	2-3	40-45	2	5	Hyperplasia
6	28	3-4	5	22	6	Hyperplasia
7	25	2-4	28	2	2	Hyperplasia
8	23	5	20	24	2	Proliferative
9	32	3-4	21-25	2	2	Proliferative
10	32	3-4	28	23	5	Proliferative
11	2	3	26-27		3	Proliferative
12	20	5-6	30	2	2	Proliferative
13	32	4-4	20-2	23		Proliferative
14	32	3-4	28	3	4	Proliferative
15	31	4-5	28	24	4	Proliferative
16	30	4	21-25	23	2	Proliferative
17	23	10	2-2	23	1	Proliferative
18	32	5-6	28-30	23	1	Proliferative
19	40	5	24-30	2		Proliferative

curettage in each instance (Table II). Of the 19 abnormal endometria 12 were of the interval (proliferative) type, 4 hypoplastic, and 3 hyperplastic (Figs 3 to 12).

CONCLUSIONS

1. Cyclic uterine bleeding, clinically indistinguishable from normal menstruation from in endometrium totally lacking the usual secretory changes, occurs in 30 per cent of sterile women who present no abnormality.

2. The condition is rarely encountered in fertile or potentially fertile women.

3. The condition may be due to failure of ovulation, a developmental or acquired lack of responsiveness of the uterus to a normal ovarian activity or to a quantitative or qualitative disharmony between the two ovarian hormones, estrin and progesterin.

4. When the diagnosis is based on endometrial findings alone, the term "pseudomenstruation" is preferable to "anovular menstruation" because the presence of the latter cannot be proved without concomitant study of the ovaries.

BIBLIOGRAPHY

1. ALLEN E. Sex and Internal Secretions. Baltimore: The Williams & Wilkins Co. 1932.
2. ASPACH B M and HOFFMAN J. Endometrial findings in functional menstrual disorders. *Am J Obst & Gynec* 1934 28 43.
3. BARTELMER G W. Histological studies of the menstruating mucous membrane of the human uterus. Contributions to Embryology. Carnegie Institution of Washington 1933 24 143.
4. BLAND P B, FIRST A and GOLDSTEIN L. The clinical investigation of functional sterility in the female. *J Am M Ass* 1935 105 1231.
5. CLABERG C. Nachweis der Wirkung kuenstlich zugefuehrten Lutealhormons am menschlichen Uterus. *Zentralbl f Gynaek* 1933 57 1461.
6. CORNER G W. The relation between menstruation and ovulation in the monkey. Its possible significance for man. *J Am M Ass* 1927 90 1348.
7. COURRIER R. Folliculine et phenomenes uterins premenstruels à la nidation de l'oeuf. *Compt rend Soc de biol* 1930 104 118.
8. ENGLE E T, SMITH P E and SHELESNAK M C. The rôle of estrin and progesterin in experimental menstruation. *Am J Obst & Gynec* 1935 20 78.
9. FALLS F H, LACKNER J L and KROHN L. Effect of progesterin and estrogenic substance on human uterine contractions. A value of progesterin in the treatment of habitual and threatened abortion. *J Am M Ass* 1936 106 21.
10. HAMBLIN E C and ROSS R A. A study of ovaries following pre-operative administration of an extract of pregnancy urine. *Am J Obst & Gynec* 1936 31 14.
11. ISRAEL S L. Evaluation of endocrine therapy in primary dysmenorrhea. *J Am M Ass* 1936 106 1695.
12. JEFFCOATE T N A. Sterility due to ovarian dysfunction. *Brit M J* 1935 1 345.
13. KAUFMANN C. Die Behandlung der Amenorrhoe mit hohen Dosen der Ovarialhormone. *Klin Wchnschr* 1933 12 155.
14. LACKNER J and KROHN L. Personal communication.
15. LEONARD S L, HISSA F L and FEVOLD H L. Studies of follicular-corpora luteum hormone relationship in rabbit. *Am J Physiol* 1932 100 111.
16. LIEBNER B. Ineffunktion und Fruchtbarkeit. *Arch f Gynaek* 1933 154 167.
17. MAZER C and HOFFMAN J. Female sterility. *Med J & Rec* 1920 129 60.
18. MAZER C and ISRAEL S L. Studies on the optimum dosage of estrogenic substances. To appear in *J Am M Ass*.
19. MAZER C, MERANJE D R and ISRAEL S L. Evaluation of the constitutional effects of large doses of estrogenic principle. *J Am M Ass* 1935 105 21.
20. MAZER C and ZISBERMAN A J. Pseudomenstruation in the human female. *Am J Surg* 1932 18 332.

- 21 MIKULICZ RADECKI, F, and KAUSCH, E. Beziehungen zwischen Kohabitation und Gravidität in jugendlichem Alter und der daraus erkannte physiologische Follikelzyklus beim Mädchen Zentralbl f Gynaek 1935, 59 2290
- 22 NOVAK, E. Recent advances in physiology of menstruation, can menstruation occur without ovulation? Underlying cause of menstruation, durability of ovarian secretions rôle of anterior pituitary in sex cycle J Am M Ass, 1930 94 833
- 23 Idem. Two important biologic factors in fertility and sterility (a) Is there a 'safe period'? (b) Anovulatory menstruation as a possible cause of sterility J Am M Ass 1934 102 452
- 24 REYNOLDS, E. and MACOMBER, D. Fertility and Sterility in Human Marriages Philadelphia W B Saunders Co., 1924
- 25 SCHROEDER, R. Ueber die zeitlichen Beziehungen der Ovulation und Menstruation (Zugleich ein Beitrag zur Corpus Luteum Genese) Arch f Gynaek 1913, 101 1
- 26 Idem. Menstruation and pseudomenstruation Am J Obst & Gynec, 1928, 16 155
- 27 Idem. Gynaekologische Blutungen, Pathogenese und Diagnose Arch f Gynaek, 1933, 156 1
- 28 SHAW, W. Ovulation and menstruation Brit M J, 1934, 1 7
- 29 SMITH, P. F. TYNDALE, H. H. and FANGLE, E. T. The reproductive system and its responses to ovarian hormones in hypophysectomized rhesus monkeys Proc Soc Exper Biol & Med, 1936 34 245
- 30 TIERZ, K. Die Follikelpersistenz mit glandulärer Hyperplasie des Endometriums in klinischer und anatomischer Beziehung Arch f Gynaek, 1934, 155 525
- 31 Idem. Die Follikelpersistenz mit glandulärer Hyperplasie des Endometriums in vergleichend pathologischer experimenteller und genetischer Beziehung Ztschr f Geburtsh u Gynaek 1934 108 79
- 32 WEFER, A. A. and COLLIER, W. D. The effect of theelin injections on the castrated woman, with histologic report J Am M Ass, 1933, 100 633

CHORDOMA

JOHN BRUCE, F.R.C.S.E., and ERIC MENIE, F.R.C.S.E., Edinburgh, Scotland

THE suggestion that notochordal remains might form the starting point of a characteristic type of tumor was originally made by Mueller in 1858. Up till then interest in the structure and fate of the primitive skeletal axis had been academic and anatomical but with this new observation the notochord acquired a practical significance. The tumor—named “chordoma” by Ribbert—is one of considerable interest, its structure is distinctive and it has a curious tendency to appear toward the extremities of the vertebral column. Reports of chordoma have become increasingly common during the last few years yet in any individual experience they are sufficiently rare to warrant the following account of two cases which we have had an opportunity of studying.

CASE 1. Mrs. G. aged 44 years was admitted to the Royal Infirmary complaining of weakness and loss of power in the legs. There was a history of a previous blow over the lumbar part of the spine but this had occasioned her but trifling inconvenience and had apparently been completely recovered from.

A year before admission she had had a severe attack of cramp in the left leg lasting 10 minutes. A fortnight later she suffered a further attack of pain in the coccygeal region and this was followed by the development of a large bluish black patch on her left thigh. Shortly afterward shooting pains began in both legs and 8 months prior to admission the limbs became stiff and she began to lose weight. Two months later she noticed that her legs were becoming numb and the numbness gradually spread until it affected both lower limbs below the knee.

On examination there was found a large swelling in the region of the lower lumbar vertebra. The tumor was stony hard in consistence but not adherent to the skin. Large dilated vessels were apparent in the subcutaneous tissues. The lower limbs were the site of an almost complete flaccid paralysis.

Radiological investigation revealed a fairly regular area of destruction on either side of the fourth lumbar vertebra. The articular and spinous processes having almost completely disappeared. The appearances were held to indicate neoplasm (Fig. 1).

At biopsy a portion of an exceedingly vascular tumor was removed for microscopical investigation.

From the Department of Clinical Surgery, Edinburgh University.

Histological appearances. The tumor was composed of sheets of cells separated into lobules by strands of connective tissue. Necrosis was present at the central part of the lobules and considerable hemorrhage had occurred in certain areas (Fig. 2).

The cells were characterized by vacuolation of their cytoplasm (Fig. 3). The vacuolation was due to the accumulation of intracellular mucin and the appearance was exactly similar to that of the physaliphorous cells originally described in connection with notochordal remains by Virchow. In some areas progressive intracellular accumulation had led to rupture of the cell envelope so that the appearance was one of a syncytium like mass of mucinoid material containing scattered nuclei (Fig. 4). As a general rule the more perfectly preserved cells were to be observed toward the periphery of the lobule and it was in this situation that mitotic activity was maximal.

The nuclei varied greatly in size, shape and staining reaction. The majority were ovoid, but round and polymorphous forms were also present. Nuclear degeneration was common in the syncytium like mass and in the necrotic areas and in some fields intranuclear vacuolation was observed though extreme examples of this phenomenon as described by Stewart were not present (Fig. 5).

The stroma was composed of a series of fibrous tissue septa in which the vessels of the tumor were running. Those cells of the lobules which lined the septa were compressed and in places had invaded the fibrous strands.

CASE 2. Mrs. McD. was 62 years of age when she was admitted to the Royal Infirmary. Seventeen months before she began to experience a gnawing pain in the region of the sacrum followed after an interval of 6 months by the appearance of a swelling about the size of a walnut in the same situation. These features appeared spontaneously there was no history of preceding trauma.

At that time the patient sought medical advice. The swelling was found to be soft in consistence and was incised apparently in the belief that it was an abscess but after incision it increased rapidly in size and at the site of incision a large ulcer developed. A diagnosis of sarcoma of the sacrum was accordingly made and was apparently supported by the fact that she began to suffer from weakness in the right leg, shooting pains in the right foot and frequency of micturition—the evidence at least of a progressive lesion.

After a course of deep x-ray therapy she improved for a time thereafter the tumor became much larger and she was admitted to the Edinburgh Royal Infirmary.

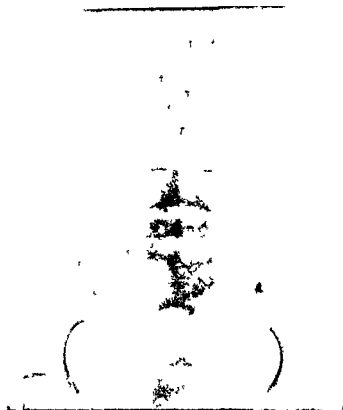


Fig 1 Anteroposterior roentgenograph of Case 1. Note the destruction apparent at each side of the body of the fourth lumbar vertebra. The transverse processes have disappeared.

When submitted to examination there, a large tumor was found to be present in relation to the lower part of the spine, the main bulk of the tumor projecting backward and downward from the sacrum. Above, it extended to the mid lumbar region, below it reached as far as the gluteal fold on the left side and to a point just above that level on the right (Fig 6). Laterally, its margin was situated



Fig 2 Photomicrograph of tumor. The tumor is broken up into lobules by strands of fibrous tissue. The cells of the lobules show marked vacuolation. $\times 50$.

immediately behind the greater trochanter. The surface of the tumor showed obvious areas of bossing and the superficial veins were enormously distended. Three small sinuses were obvious at the site of the previous incision (Fig 7).

The tumor on palpation appeared for the most part firm and hard in consistence, but here and there were areas of softening, almost suggesting fluctuation.

Abdominal examination conveyed a sense of fullness and increased resistance at the pelvic brim, while the digital investigation of the rectum revealed a tumor bulging forward through the posterior rectal wall, the growth again had suggestive

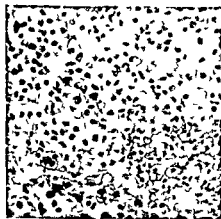


Fig 3

Fig 3 High power photomicrograph showing the vacuolation of the cells. $\times 140$.



Fig 4

mass of mucinoid material with many scattered nuclei. $\times 130$.



Fig 5

Fig 5 Photomicrograph to show vacuolation of nuclei. $\times 550$.



Fig. 6 Lateral photograph showing the extent of the tumor in Case 2



Fig. 7 The surface of the tumor in Case 2. The sinuses at the site of the previous incision are well seen

areas of softening although the main consistence was firm almost to hardness.

Radiological examination (Fig 8) was carried out with great difficulty and owing to the adiposity of the patient the roentgenograms were far from perfect. They showed however that the sacrum and coccyx were almost completely replaced by a large and ill defined tumor, which appeared to be more dense in the position of the bony column. On the right side the sacro iliac joint was almost completely destroyed. On the left side also it had been invaded but to less extent by the tumor.

A fruitless attempt was made to remove the tumor. When the skin and subcutaneous tissues had been incised the underlying muscles were seen to be stretched out over the growth which was partially surrounded by a fibrous capsule. The surface was lobulated save where the neoplastic process had extended into the muscle. Owing to its infiltrating character and to pronounced vascularity radical extirpation was considered impossible and the attempt was abandoned. A small portion however was removed for histological study.

Histological examination The microscopic appearances were essentially similar to those of the first case but the tumor was less cellular and the individuality of the cell more uniformly preserved. Lobulation by fibrous septa was less marked (Fig 9).

The recognition of notochordal tumors is a matter of the last 30 or 40 years, and is due mainly to the observations of Ribbert. Luschka in 1856 had reported a curious jelly-like intracranial growth protruding from the clivus, but could not account for its presence. Virchow, a year later, described a similar tumor in a comparable situation, which his histological observations led him to believe was of cartilaginous origin. He regarded the cartilage cells as degenerate, and accordingly

referred to these growths as physaliphorous echondroses.

In the following year, Mueller suggested that similar tumors might grow from notochordal remains. He made a close study of the development and histology of the notochord and was able to show that in the fetus it extended cranially as far as the sella turcica. He also showed that "rests" of notochordal tissue could occur in the basilar cartilage while in the spheno occipital synchondrosis it frequently persisted as a small mass of soft jelly like tissue resembling the nucleus pulposus of an intervertebral disc.

It was left to Ribbert to produce incontrovertible proof and to suggest the name chordoma. Ribbert's evidence is of three kinds— anatomical, histological, and experimental. He emphasized that, as regards the skull, the tumor is constantly situated in the midline where notochordal tumors would inevitably occur. From a histological study of the tumors, he concluded that the resemblance of the tumor cells to degenerate cartilage was more apparent than real and he was unable to find any areas of normal cartilage.

His experimental evidence is very important. He punctured the intervertebral disc of a rabbit so that the notochordal tissue of the nucleus pulposus was extravasated outside the vertebral column. Subsequently the herniated tissue proliferated and presented the histological features of the physaliphorous echondroses.



Fig 8 Roentgenograph of Case 2 The sacrum is completely destroyed and the indefinite outline of the tumor can be vaguely determined

It is now fairly clear that the physaliphorous ecchordosis of Virchow—or, to give it the more accurate title of Stewart—ecchordosis physaliphora spheeno-occipitalis, is not a true tumor. It is not infrequently encountered by chance during autopsy for some unrelated condition, and it appears more likely that it is a true persistence of notochordal tissue which may, however, undergo neoplastic transformation into chordoma.

Since 1894, a considerable series of notochordal tumors have been added to the literature, and the condition is now a well defined clinical and pathological entity.

The localization of the tumor One of the most curious features of chordoma is the site localization. The original descriptions were of intracranial growths in the region of the spheeno occipital synchondrosis, and Hennig was the first authority to report on extra-cranial chordoma—in the sacro coccygeal region of a young infant. The occurrence of the tumor in sites other than the extremities of the spinal column was not appreciated until Syme and Capell (11) in 1925 reported a chordoma of the cervical spine. Capell (1) has since reported the development of the tumor in the dorsal spine.

We have traced in the literature the records of 103 cases, of which the distribution is as follows:



Fig 9 The histological appearances in Case 2 The tumor is essentially similar, but less cellular. Cell vacuolation is again prominent. $\times 100$

	Cases
Cranial	
Spheeno occipital	33
Occipital	1
Jaws	2
Sacro coccygeal region	56
Intermediate part of spine	
Cervical	6
Thoracic	1
Lumbar	4

The spheeno occipital group includes growths which project intracranially from the synchondrosis, and those (11 of 33 cases, i.e. 33 per cent) which project into roof of pharynx.

To explain the site localization of chordoma, it is necessary to review briefly the development of the notochord.

The development of the notochord In the second week of intra-uterine life, a linear furrow is formed in the central axis of the embryonic area by a thickening of the embryonic ectoderm. This is the primitive groove, and from its anterior end, the growth in length of the embryo takes place. At the anterior end of the groove, an opening is situated which represents the dorsal extremity of the neurontic canal.

In the third week, the ectoderm has extended forward from the primitive groove for a considerable distance, and a central furrow is apparent the lateral walls of which even-

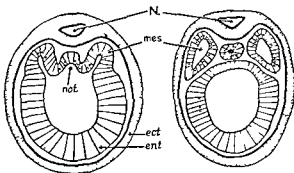


Fig 10 Diagram to show the method of formation of the notochord by evagination from the dorsal aspect of the archenteron (After Frazer)

tually expand grow toward each other and fuse to form the *neural tube*

Immediately below the dorsal ectoderm is the archenteric cavity with its enclosing layer of entoderm. In the midline of the body ectoderm and entoderm are in direct apposition but laterally the two layers are separated by the paraxial mesoblast.

By about the middle of the third week a strip of cells along the median dorsal wall of the entodermal archenteron are evaginated (Fig 10) to form a tube—the *notochordal canal*—which later loses its lumen and becomes finally detached from the entoderm to form the notochord, a solid rod of cells interposed between the developing neural groove and the archenteron.

The fate of the notochord The paraxial mesoderm later comes to surround the notochord and to form a sheath for it as also for the neural tube; the sheath is the anlagen of the vertebral column.

The major part of the notochord begins to disappear in the second month of fetal life and from the point of view of the present communication interest mainly centers round the situations in which it may or does persist.

The membranous sheath becomes chondrified and later ossified forming at the anterior extremity the basiocciput and the basi-sphenoid and elsewhere the vertebral column. The progress of ossification in the individual vertebra leads by pressure to the disappearance of the notochordal tissue in the center of the vertebral body but in the intervertebral space, a spheroid of tissue persists as the nucleus pulposus.

At the anterior end, the notochord traverses the middle of the body of the dens and passes up to the cartilaginous base of the skull in the suspensory ligament of the dens. At first it is included between the developing halves of the skull base, but further forward, it passes on to the pharyngeal surface of the base, and finally turns upward to terminate in the skull base posterior to the dorsum sellæ (Fig 11).

Such are the usual cranial relationships of the notochord, there is no doubt, however, that in the region of the sphenoccipital synchondrosis the notochord may make a further loop upward and come to lie on the actual cranial aspect of the base (Fig 11). It may be said, therefore, that normally in one, and possibly in two situations in relation to the skull base, the notochord may escape being confined within or compressed by, cartilage or bone.

- 1 At the site of the intrapharyngeal loop
- 2 In the region of the sphenoccipital synchondrosis where it often makes an intracranial loop

In the sacrococcygeal region a destructive fate also befalls the posterior end of the notochord. Along with its membranous sheath it extends for a considerable distance beyond the extent of the adult vertebral column—and even beyond the termination of the membranous sheath it is continued into the tail end of the embryo (Fig 12). With the curtailment of the coccygeal end of the vertebral column and the disappearance of the tail bud, a considerable part of the caudal end of the notochord must disappear.

The relation of development of tumor growth
It is significant that notochordal tissue normally persists in the intervertebral discs, that abnormal persistences have been reported on the cranial aspect of the sphenoccipital synchondrosis, and that the majority of chordomas arises in the basicranial and sacrococcygeal regions. The factor common to these situations of normal, abnormal, and pathological occurrences of notochordal tissue is the absence of bony compression. It seems that once encased in bone, the notochordal tissue does not usually survive, but in the absence of a bony envelope it may, and often does, persist. In the situations where ab-

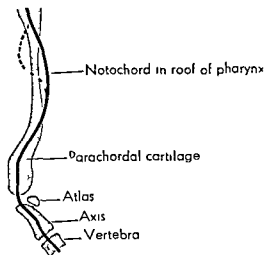


Fig 11 Diagram to show the course of the notochord at the base of the skull. The usual course is indicated by the continuous line. The interrupted line represents the occasional incursion on to intracranial aspect of the base (After Keith)

normal persistences have been shown to be likely, there is the further feature that the notochordal tissue is not even restrained by a sheath of fibrous tissue as in the case of the nucleus pulposus of the discs. That these facts may have some relation to subsequent tumor development is likely. Thus Newlands ascribes chordoma to persistence of notochordal tissue when it escapes inclusion by bone, while Ribbert's (8) classical experiments suggest that in these situations it may be the absence of proper fibrous tissue encapsulation that is the significant circumstance.

The relation of trauma to the chordoma. In the first of our cases, the lumbar segment of the spine was affected, and there was a definite history of injury preceding the development of the tumor. It is difficult to dissociate the two as cause and effect, and there is additional evidence that the relationship may be a direct one. The occurrence of such tumors in the intermediate part of the spine at once suggests an origin from the nucleus pulposus of the intervertebral disc, and Ribbert's experimental production of chordoma following the release of the nuclear tissue from its fibrous sheath by puncture suggests that the traumatic influence may be important.

The recent researches of Schmorl and his Dresden co-workers seems to strengthen this view, for the escape of notochordal tissue from the disc into the spongy tissue of the

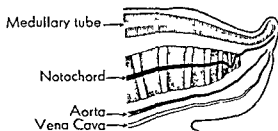


Fig 12 Schematic representation of the caudal relations of the notochord, which is here continued beyond the termination of the vertebral column

vertebral body and anterior and posterior aspects of the body is an occasional feature of spinal injuries. Schmorl indeed remarks on the occurrence of nodules of notochordal tissue on the posterior aspect of the lumbar bodies, but suggests that in some cases they may have a congenital origin. Dandy, too, has operated on 2 cases in which spinal cord compression has resulted from tumors growing from the back of the vertebral bodies, and apparently cartilaginous in nature. In the light of recent work, they are certainly of notochordal origin and their structure is in all respects similar to the physaliphorous echordosis of the sphenoccipital region.

It would appear, therefore, that chordomas may arise in two ways:

- 1 From the persistence of notochordal tissue in abnormal situations
- 2 From the traumatic release of notochordal tissue from situations in which it is normally found but imprisoned in a fibrous envelope

The pathology of chordoma. The account of the pathological features of chordoma given by Stewart is so complete that addition to it is impossible.

The tumor is usually encapsulated, rounded, and lobulated by a series of thick fibrous septa. Its cut surface is glistening, and in many of the lobules there is mucoid degeneration so that the consistence of the tumor is semi solid. Hemorrhages of varying size and age are present in those degenerate areas, but when the mucoid change is less advanced the tumor may appear granular and opaque.

The histological features. All the recorded cases reviewed by Stewart were broken up into lobules by a stroma composed of fibrous septa. The connective tissue of the stroma is prone

to hyaline degeneration and may be infiltrated with lymphocytes, polymorphonuclears or eosinophile cells. Frank hemorrhage is not infrequently observed and evidence of former hemorrhages sometimes exists in the form of pigment-distended reticulo endothelial cells. The parenchyma of the tumor presents a very variable appearance. Active cellular tissue may be present, the cells polygonal in outline and with fairly well defined borders. These cells are more usually present toward the periphery of the lobule, but occasionally comprise a whole lobule.

The mechanism of mucoid regeneration is invariably apparent. As the cell is traced from the periphery of the lobule toward the center, droplets of mucin collect within the cytoplasm, giving rise to the appearance of vacuolation. The accumulation of mucin proceeds until the cell is distended and the nucleus displaced until ultimately the cell envelope, unable to contain the increasing mass of mucin, ruptures. The mucin now escapes and lies free between and around the shrunken cells in the central area of the lobule.

The nuclei of the cells may vary greatly in appearance, but are for the most part oval or spherical. In the areas of greatest mucoid change, however, they may be shriveled and crenated. In the more cellular areas they may contain one or more vacuoles of mucin and occasionally may become so distended that they are ballooned out forming the typical physaliphorous nuclei first described by Stewart. Hyperchromatism and active mitotic activity are only present in certain cases of malignancy.

Relation of the histology to the cytomorphosis of the notochord. It is now apparent that, in their histology, notochordal tumors reflect the cytomorphosis of the original notochord. Capell, Newlands and Woolard have drawn attention to the fact that the notochord at first consists of a rod of polygonal epithelium like cells arranged in front of the developing nervous system along the whole length of the embryo. These cells originally have no peripheral delimitation from the surrounding structures, but they soon acquire a sheath which has developed from the adjacent mesoderm.

The cells next undergo mucinoid degeneration, toward the periphery of the rod the mucin is discharged from the cell and comes to surround the column as a secondary or internal sheath. In the center of the column the mucin is contained within the cell envelope, and to the consequent turgescence of its cells the notochord owes its supporting properties.

In the last stage—seen in the intervertebral disc—when the notochord is enclosed in fibrous tissue, the cell envelope may be destroyed and the nucleus left embedded in a syncytium like mass of mucinoid material.

There are thus three stages in the cytomorphosis: (1) the stage of non-vacuolated polygonal cells, (2) the stage of vacuolated mucin containing cells, (3) the syncytial stage of intercellular mucoid accumulation.

These stages are reproduced with faithful exactitude in chordoma, and from the preponderance of any one of the above appearances in individual tumors, some information as to its relative malignancy may be gained. Thus, the cellular tumors, with little or no vacuolation, represent the most malignant type, the syncytial arrangement of the tumor cells the most benignant form of neoplasm.

CLINICAL ASPECTS OF THE CHORDOMA

The cranial chordoma. The intracranial type. The intracranial type of tumor begins near the sphenoid occipital synchondrosis and tends to extend at the expense of the surrounding bone, and of the brain. Thus it may erode the dorsum sellæ and invade the pituitary, while it also spreads ultimately to involve the brain stem.

The nasopharyngeal tumor is situated in the roof of the pharynx but it may spread to involve the nose and jaws or the maxillary antra. In at least one reported case, the tumor—in a newborn infant—actually projected from the mouth.

The sacrococcygeal chordoma. In many of the published cases of sacrococcygeal neoplasm injury appears to have been a precipitating factor but in our case, no such trauma appears to have occurred.

Usually, as in the present case, the first evidence of trouble is severe pain in the region

of the sacrum, followed, after an interval, by the appearance of the tumor. The tumor may show its most exuberant growth either anteriorly or posteriorly, if it tends to spread to the front, interference with micturition and defecation are early evidences of its presence.

In virtue of its position, the tumor may early implicate the pelvic nerves; indeed, it may be that the visceral disturbances mentioned are the result of disordered nerve impulses rather than of mechanical pressure, though it is likely both factors are at work.

The tumor is at first situated above the mid-line, but, as it enlarges, its situation becomes more asymmetrical. The surface frequently shows bossing, and the veins of the subcutaneous tissues become prominently dilated.

In the present case, there was, in addition to the features stated, marked weakness of the leg, and pain in the distribution of the sciatic nerve. The latter, as well as the other gluteal nerves, may be surrounded and infiltrated in large tumors which grow down into the region of the buttocks.

The spinal chordoma. No region of the spine is immune, but chordoma is relatively rare in the lumbar region. A history of antecedent trauma is common.

The tumor usually commences on the posterior aspect of the vertebral bodies, and it follows that the earliest signs of its presence are due to its compressive effects on the spinal cord. In the higher segments of the spine the sequelæ are spastic paraplegia below the lesion with increasing sensory disturbance until numbness and anesthesia result.

In the lumbar region, however, the neoplasm in its advance implicates the cauda equina, and there is a flaccid paralysis of irregular distribution in the lower limbs, as in the first case reported here.

The lumbar chordomas are more often preceded by a history of recurrent attacks of pain than the others, since the sensory nerves are more rapidly encompassed.

PROGNOSIS IN CHORDOMA

The prognosis in chordoma varies with the position, the duration, and the histological

type of the tumor. In some cases—as in small intracranial and intrapharyngeal tumors, and in small intraspinal tumors—removal has been successfully accomplished. Young has also been able to extirpate completely a large sacrococcygeal tumor. In the sacrococcygeal chordoma reported here, however, the extension of the tumor beyond its capsule, and its vascularity made removal impossible.

In the event of removal of the tumor proving impossible, even a simple chordoma is ultimately fatal from encroachment on vital structures. This eventuality may be delayed for many years—as in Young's case—however, in the more malignant types of tumor, histologically very cellular, death may result very soon after the tumor becomes apparent.

TREATMENT OF CHORDOMA

It is evident that no universal technique for the management of chordoma can be indicated. Removal should be attempted in all save late cases, as even partial resection has been followed by improvement in symptoms.

When the situation of the growth or other circumstances render operation hazardous or impossible, recourse may be had to radium or deep x-ray therapy, though these have so far proved of very limited value.

Our thanks are due to Professor Sir John Fraser for his permission to investigate and report these cases, which were under his charge in the Royal Infirmary, Edinburgh. Mr. D. B. Smith has been responsible for the photomicrographs and our grateful thanks are due also to him.

REFERENCES

1. CAPELL J Path & Bacteriol, 1928 31 797
2. DANDY Arch Surg, 1929 29 660
3. HENNING Beitr z path anat u z allg Path, 1900 28 593
4. LUSCHKA Arch f path anat 1856, 9 8
5. MUELLER Ztschr f rat Med, 1858 2 202
6. NEWLANDS and WOOLARD J Coll Surg Australia, 1929 11 157
7. RIBBERT Centralbl f allg Path, 1894 5 457
8. Idem Verhandl d Congr f inn Med, 1895 13 455
9. SCHMORL A complete account of Schmorl's observations is contained in a special report of the Medical Research Council by Beadle 1931, No 161
10. STEWART J Path & Bacteriol, 1922, 25 40
11. SYME and CAPELL J Laryngol & Otol, 1926, 41 209
12. VIRCHOW Untersuchungen ueber die Entwicklung des Schadelgrundes Berlin 1857
13. YOUNG Surg, Gynec, & Obst, 1929, 49 333

DERMOID CYSTS OF THE HEAD AND NECK

GORDON B. NEW, M.D., F.A.C.S., and JOHN B. ERICH, M.D., Rochester, Minnesota

WHILE dermoid cysts of the head and neck are of relatively infrequent occurrence, they should nevertheless be of interest to both those who specialize in surgery of the head and neck and to general surgeons as well. From 1910 to 1935, inclusive, 1,495 patients with dermoid cysts have been examined at The Mayo Clinic.

The distribution of the 1,495 cysts, which involved the entire body, may be noted in Figure 1. The greatest number of cysts (44.4 per cent), which included pilonidal cysts, occurred in the postanal region, 42.1 per cent of the cysts were found in the ovaries. Excluding patients who had cysts involving the brain and meninges, 103, or 6.9 per cent, of the patients had cysts that occurred in the regions about the head and neck.

SITUATION

We have divided dermoid cysts of the head and neck into four groups, in accordance not only with their anatomic situation, but also with the embryonic structure from which each group is derived: (1) cysts about the eyes and orbits, originating along the naso-optic groove, (2) those about the nose, resulting from intrusion of the frontonasal plate between the embryonic nasal dermis and mucosa, (3) those about the floor of the mouth and in the submental and submaxillary regions originating from the upper branchial arches, and (4) a miscellaneous group, most of which occur in the midline and develop during closure at the midventral and middorsal lines of the body (Fig. 2).

Of the 103 dermoid cysts about the head and neck, 49.5 per cent came under the classification of group I, 12.6 per cent of group II, 23.3 per cent of group III, and 14.6 per cent of group IV (Fig. 3).

From the Section on Laryngology, Oral and Plastic Surgery, The Mayo Clinic. Read before the meeting of the Section on Otolaryngology of the College of Physicians of Philadelphia, Philadelphia, Pennsylvania, October 21, 1936.

EMBRYOLOGY AND PATHOLOGY

Dermoid cysts in general have been classified on the basis of their pathogenesis as well as their gross and microscopic appearance into the following three types:

1. Congenital dermoid cysts of teratoma type. These are complex in structure and arise from embryonic germinal epithelium. According to the blastomere theory, such a tumor is thought to originate in a developing blastomere, some cells of which become separated or displaced, the remaining cells of the blastomere develop into normal cells, whereas the misplaced cells lie dormant. Later, however, perhaps through some chemical process, these dormant cells become activated and evolve a dermoid or a teratoma. Dermoid cysts of this type have a thick wall which contains elements derived from any one, or from all three, of the germinal layers: epithelium, bone, and cartilage. These cysts also contain well developed structures, such as skin, hair, nails, and teeth. Brain and glandular tissues frequently are present. Usually cysts of this type are confined to the ovaries and testes, although occasionally they are found elsewhere, as in the sacral region.

2. Acquired implantation dermoid cysts. These are merely inclusion cysts that develop as a result of trauma. A portion of the skin is carried into the deeper structures of the wound where the dermal cells form a cyst lined with squamous epithelium. They occur particularly on the hands and other exposed parts of the body.

3. Congenital inclusion dermoid cysts. These develop along the lines of embryonic fusion, such as the midventral and middorsal lines and the branchial clefts. They are cysts that develop from inclusions of displaced dermal cells along such lines of fusion. Histologically they are very simple in structure. Their walls usually are thick and fibrous and are lined with squamous epithelium that resembles skin and contains hair follicles and

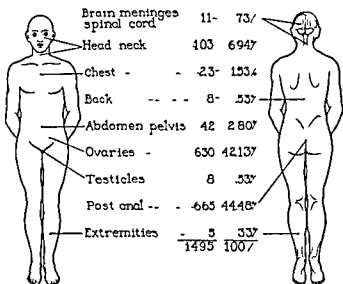


Fig 1 Distribution of 1,495 dermoid cysts encountered at the clinic

sweat and sebaceous glands. The cavities of these cysts are filled with a greasy caseous material which is often mixed with hair. Such structures as cartilage, bone, and lymphoid tissue are said to be found occasionally. Many of these cysts have a sinus from which sebaceous material can be expressed and from which, in some instances, hairs can be seen protruding.

Almost all of the 103 dermoid cysts in this series which involved the head and neck contained sebaceous material, but in only 30 per cent of them were tangles of hair to be found. Microscopically, their walls were typical of congenital inclusion dermoid cysts. With the exception of one cyst in the upper outer quadrant of the right orbit in which a little cartilage was discovered, no cartilage, bone, or lymphoid tissue was found in any of them. None contained such organized structures as teeth, nails, or glandular tissues. Many were infected, their capsules being somewhat adherent to the surrounding tissues and their cavities containing much pus intermixed with the sebaceous material.

It is interesting to observe that in one case in which a dermoid involved the soft palate a squamous cell epithelioma, grade II, developed. The patient was a woman 53 years of age. She had noticed the growth for about 18 months. A year prior to her registration at the clinic it had been excised, but it had promptly re-

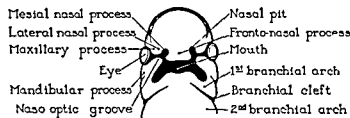


Fig 2 Origin of cysts of head and neck

curred and had grown rather rapidly. Examination revealed a rounded, non-ulcerated, and well localized mass. On excision, the dermoid and the malignant lesion were discovered, and consequently the bed of the tumor was thoroughly cauterized. The patient made a complete recovery.

Cysts of group I which occur in and around the orbital region develop, as has been said, along the naso optic groove which lies between the maxillary and mandibular processes. During fusion of these processes, small groups of cells dip down into the deeper tissues and become segregated from the surface epithelium. In time these epithelial rests develop into dermoid tumors. It is not surprising that a greater percentage of these cysts occur in the orbital region than elsewhere about the head and neck when one considers the complexity of the embryonic development of the eyes and lids, which are situated at the outer angle of the naso optic groove.

The pathogenesis of dermoids of group II, which occur over the nasal bridge, is difficult to explain. Luongo interpreted their formation as follows: "In the early embryo, the frontonasal plate, which forms the nose, consists of a lamina of hyaline cartilage covered

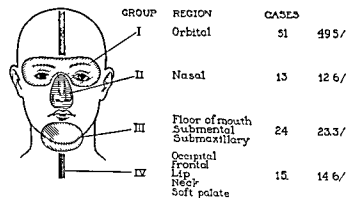


Fig 3 Classification of cysts of head and neck according to groups



Fig 4 Pre auricular sinus branchial cleft in father and son

externally with skin and internally with mucosa. After the third month of embryonal life, bony tissue extends in between the cartilage and skin. The bony tissue will form the nasal bones. The cartilage becomes absorbed during the process of ossification. During the gradual separation of the skin from the cartilage of the frontonasal plate by the intrusion of the nasal bones, small portions of the skin or epithelium become sequestered and develop into dermoid cysts. Dermoid cysts that occur in the base of the columella and in the adjacent upper lip may develop during fusion of the two mesial nasal processes.

Dermoid cysts of group III, which arise in the floor of the mouth and in the submental region, are derived from ectoderm sequestered during union of each first and second branchial arch with its fellow of the opposite side. There is also a group of cysts in the zygomatic and parotid regions (Fig 4) which clinically resemble dermoid or branchial cysts. From the embryologic point of view, of course, these should be dermoid cysts arising from the branchial arches, however, they have been classified as branchial cysts because of their microscopic appearance.

Cysts of group IV, those in the suprasternal fossa and in the occipital region, are formed during closure of the midventral and mid-

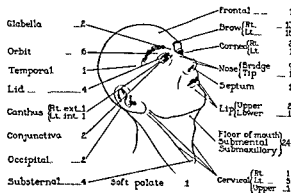


Fig 5 Situation of cysts of head and neck

dorsal lines. Fusion of the branchial arches is doubtless responsible for some dermoids in the laryngeal and upper cervical regions. Such a cyst in the lower lip results from union of the mandibular processes, whereas a cyst located in the soft palate results from the fusion of the palatine plates which grow from the maxillary processes to the midline to form the palate.

Dermoid cysts in the frontal region and other parts of the cranium arise during fusion of the cranial bones. As has been explained by several authors, the developing cranial bones lie between the embryonic skin and dura. As the bones grow toward each other to form the suture lines, groups of dermal cells become cut off from the surface epithelium, and this results in the formation of dermoid cysts.

From pathological study of these 103 dermoid cysts, it appears that practically all dermoids about the head and neck are very simple cysts of the congenital inclusion type. Although they may arise from several different embryonic structures, fundamentally all have a similar origin.

AGE OF PATIENTS AND SIZE OF CYSTS

Of the 103 patients, 53 (51 per cent) were males and 50 (49 per cent) were females. The ages of the patients at the time of operation varied from 14 months to 72 years, about 60 per cent being between the ages of 15 and 35 years. This, however, does not correspond in any degree to the ages of the patients at the time when the dermoid first became notice-

TABLE 1—AGE AT WHICH DERMOID CYSTS OF THE HEAD AND NECK WERE FIRST NOTICED

Age	Cases	Per cent
At birth	32	37.2
From birth to 1 year	9	10.4
2 to 5 years	13	15.1
6 to 10 years	4	4.6
11 to 15 years	5	5.9
16 to 20 years	6	6.9
21 to 30 years	0	0.0
31 to 40 years	1	1.1
41 to 50 years	2	2.3
51 to 59 years	2	2.3
Total	86	
Age when first noticed unknown	17	

able. As may be noted in Table 1, 37.2 per cent of the tumors were present at birth, whereas 62.7 per cent were observed by the fifth year. One patient did not notice the cyst until he was 59 years old.

The cysts ranged from 4 millimeters to 10 centimeters in diameter, the larger ones being located in the floor of the mouth and in the submental region. In 26 per cent of the cases there was a history of previous attempts at removal or of incisions for drainage.

DERMOID CYSTS OF THE ORBITAL REGION

Fifty-one cases in which dermoid cysts occurred in the orbital regions have been encountered at the clinic. The most common site for these tumors is on the outer third of the brow, in fact, more dermoids are encountered in this region than in any other part of the head and neck, 31, or 60 per cent, of the 51 cysts being in this situation (Fig. 5).

The left brow was involved more frequently than the right. These 31 dermoids varied from 1 to 6 centimeters in diameter, the majority measuring 2 or 2.5 centimeters. Larger cysts extended laterally into the temporal regions or down into the upper eyelids. All but one were evident by the fifth year, and 52 per cent were present at birth. Several of them were not noticed until they were injured accidentally. In a few cases trauma caused the affected tumors to undergo a sudden increase in rate of growth. Except for slight tenderness or a discharging sinus, which occurred in 2 cases, these dermoids were practically symptomless. The patients came for



Fig. 6 Dermoid cyst of right brow

operation merely for removal of a disfiguring "lump" on the brow (Fig. 6). On palpation, a few of the cysts, especially smaller ones, were firm, the majority, however, were soft and cystic. In some cases a sense of fluctuation could be elicited, and in the case of large tumors a doughy feeling, so characteristic of dermoid cyst, was present. Some were fixed to underlying bone whereas others were freely movable.

On excision, several of these tumors were found to have produced crater-like depressions in the underlying bone. In an occasional case, cord-like extensions into the surrounding soft and bony tissues were discovered. Dermoids are but rarely seen at the inner angles of the brows. In our experience we have seen only 3 such cases.

Six of these 51 orbital dermoids were located within the orbit (Fig. 5), 5 of them being in the upper outer quadrant of the right orbit. When large, such tumors have a tendency to produce exophthalmos.

While we have not seen a dermoid involving the lower lid, 4 dermoids involving the upper eyelids and 2 of the canthi were encountered (Fig. 5). Two of these dermoids were of sufficient size to cause blurring of vision. From



Fig 7 Dermoid cyst of the nose affecting both mother and daughter

one dermoid, situated on the cornea, three hairs protruded and caused considerable irritation of the conjunctiva

The treatment of orbital dermoid cysts is excision. When adherent to bone, the periosteal attachment must be removed along with the tumor. Cord like extensions should be removed, when present, if a cure is to be effected.

DERMOID CYSTS OF THE NOSE

Of the 13 dermoid cysts that involved the nose, 9 involved the bridge, 1 the tip, 2 the base of the columella, and 1 the septum (Fig 7). All of those on the bridge were first noticed in infancy, 6 of them at birth. They varied from 4 millimeters to 2.5 centimeters in diameter averaging about 1 centimeter. The histories obtained in these cases revealed that these dermoids usually began as a small nodule or papule, white, reddish, or dark blue. Later, they often became visible through the skin as a sinus, which might or might not discharge sebaceous material. In some cases the region, aside from slight and gradual enlargement, caused no discomfort. The masses might become infected and periodical



Fig 8 Dermoid cyst of the upper lip showing the sinus in the midline at the base of the columella.

swelling, redness and pain as well as a purulent discharge.

The 2 dermoids involving the base of the columella and upper lip also were apparent in early infancy, 1 at birth. In both cases a sinus from which sebaceous material discharged was present. In 1 of these cases the tumor gave the patient no trouble until he was 45 years of age (Fig 8).

A dermoid of the septum in the case of a boy was of special interest because the tumor was associated with a congenital median cleft of the tip of the nose, columella, and upper lip. There was a marked tendency toward reduplication of the nose. When the patient was 7 weeks old primary closure of the cleft was effected by his family physician. Thirteen years later the boy registered at the clinic to undergo further surgical treatment to improve the cosmetic appearance of his nose. During a plastic procedure to correct the residual deformity a dermoid cyst was encountered in the tissue just above the tip of the columella. It was measured and found to be 1.5 cm in diameter. A small portion of orbital fat was removed along with the cyst. The treatment was successful. When the patient was 15 years of age he should be rechecked for the cyst. Such treatment



Fig 9 Dermoid cyst of floor of mouth and submental region

attached firmly to the underlying periosteum, but also have a tract or sinus of dermoid tissue that extends down between the nasal bones into the septum. When adherent, it is well to excise a portion of the periosteum in order to insure complete removal of the cyst. A tract between the nasal bones that extends deep into the septum offers a troublesome problem, as attempts to remove the surrounding bone and excise the tract result in much deformity. When excision is inadvisable, such a tract often may be removed by light cauterization with diathermy, a current of insufficient strength to cause sequestration of the adjacent bone being used.

DERMOID CYSTS OF THE FLOOR OF THE MOUTH AND IN THE SUBMENTAL AND SUBMAXILLARY REGIONS

As pointed out by Colp, the mylohyoid muscle, which serves as a diaphragm between the mouth and the neck, separates dermoids of the floor of the oral cavity from those occurring in the submental and submaxillary regions. When large, such cysts in the floor of the mouth bulge into the submental region, although they still are situated above the mylohyoid muscle. On the other hand, large submental and submaxillary tumors push this

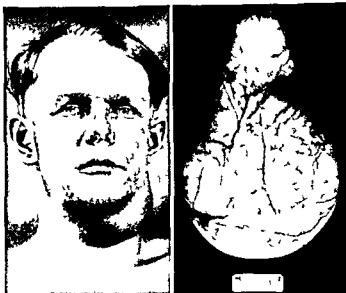


Fig 10 a, left, Dermoid of submaxillary region extending into the floor of the mouth, and b, specimen removed at operation

muscle upward in the floor of the mouth. We have seen 2 cases in which the dermoids originated in the floor of the mouth, but with gradual growth penetrated the mylohyoid muscle, passed between its fibers, and appeared in the submaxillary region. In 1 of these cases, a constriction formed by the diaphragm muscle could be seen at the junction of the upper and middle thirds of the cyst. This cyst measured about 10 by 7 centimeters.

At the clinic, 13 dermoids have been encountered above the mylohyoid muscle in the floor of the mouth, 9 below this muscle in the submental and submaxillary regions, and 2 passing between the muscle fibers of the mylohyoid muscle to involve the submaxillary region as well as the floor of the mouth.

The youngest patient in this group was 11 years of age, the oldest 59, the majority of these patients were operated on when between the ages of 15 and 35 years. In contrast to nasal dermoids, only 2 of this group of 24 tumors were present at birth, 1 was noticed in infancy and the 21 remaining first became evident when the patients were between the ages of 9 and 59 years.

The majority of these cysts occur in the midline and are elongated rather than round in shape. They varied in their greatest diameter from 4 to 10 centimeters, the average

diameter being between 6 and 7 centimeters. These cysts were remarkably free from hair, as in only 4 of the tumors was any hair to be found.

According to the histories obtained in these cases, the greater number of the patients had noticed a lump or swelling either in the floor of the mouth or below the chin for days, months, or even years before other symptoms occurred. In 2 cases however the patients were at first entirely unaware of the presence of a swelling, being conscious only of impaired articulation when speaking. In a few cases the swelling appeared suddenly and this probably was caused by infection. In 1 such case, in which the tumor involved the right submaxillary region and bulged into the right side of the pharynx it was incised for a peritonsillar abscess. Several of these dermoids became infected resulting in periodic attacks of acute inflammation with swelling, the cysts became very tense and ruptured either into the mouth or externally.

When these cysts swell to large proportions, either in the course of their natural growth or through infection the tongue is often pushed upward against the palate, this causes difficulty in articulation, mastication, and deglutition. While dysphagia and dyspnea occur rarely, they are at times serious.

On examination of these patients, a swelling may be seen in the floor of the mouth or in the submaxillary or submental regions (Figs 9 and 10). The tongue was often found to be pushed upward, in 1 or 2 cases to such a degree that it was impossible to obtain a view of the pharynx. On palpation these cysts had the characteristic doughy feeling. Some were rather soft some tense and in some, fluctuation could be elicited. In a few cases a sinus was present which discharged sebaceous or purulent material, either externally or into the mouth.

Dermoids in the floor of the mouth or in the submental and submaxillary regions must be distinguished from ranulas, cystic hygromas, cysts of the thyroglossal duct, chronic suppurative infections of the submaxillary salivary gland, branchial cysts, lipomas and neurofibromas. The one notable feature which distinguishes a dermoid in these regions

from the before mentioned conditions is its "putty-like" or "doughy" feeling on palpation.

Extirpation of dermoid cysts above or below the mylohyoid muscle is the treatment of choice. The smaller tumors, which are definitely situated above this muscle, can best be removed through the floor of the mouth. A midline incision is employed which not only makes for a minimum amount of bleeding, but entails the least amount of trauma to the surrounding tissues. After a line of cleavage is established, the cysts are removed by digital or blunt dissection. In some instances in which there is excessive scarring about the tumors, which is caused either by previous attempts at removal or by infection, excision is very unsatisfactory. In such cases the tumor may be destroyed by cauterization of the lining by diathermy.

Large dermoids of the floor of the mouth that bulge into the submental region, and all such cysts lying in the midline below the mylohyoid muscle, can be excised through an incision in the submental region. In the submaxillary region the cysts are best removed by means of a transverse incision parallel to, and just below, the horizontal ramus of the mandible.

OTHER DERMOID CYSTS ABOUT THE HEAD AND NECK

As previously described, all but one of the dermoid cysts in group IV (Fig. 3) were situated at or near the midline. Four cysts in the suprasternal fossa ranged from 2 to 5 centimeters in diameter. Aside from gradual growth, they produced no symptoms other than occasional attacks of dyspnea and choking.

Near the midline in the laryngeal region 5 dermoids were encountered. With the exception of 1 which intermittently discharged a thin yellowish material none of them caused the patients any discomfort. No sinus leading to the pharynx from any of these cysts was found, although such cases have been reported in the literature.

Two dermoids occurred in the occipital region. In each case the cyst was present at birth. One reached a size of 8 by 10 centi-

meters and the patient thought it caused severe headaches, the other was small but had a sinus which penetrated the skull

The other cysts in this group were of no particular interest other than because of their situation to which reference has previously

been made All of these cysts were removed by excision

BIBLIOGRAPHY

- 1 COLP RALPH Dermoid cysts of the floor of the mouth Surg, Gynec & Obst, 1935 40 183-195
- 2 LUONGO R A Dermoid cyst of the nasal dorsum Arch Otolaryngol 1933 17 755-759

A STUDY OF OSGOOD-SCHLATTER DISEASE

JAMES P COLE, M D, D Sc (Med), New York, New York

OSGOOD in 1903 and Schlatter in 1908 described a lesion of the tibial tubercle which bears their names and is generally recognized as a distinct clinical entity Since the original articles were published many observers have attempted to expound the etiology, pathology, and treatment of the condition

ETIOLOGY

Evidence is presented in the following paragraphs to demonstrate the causation of the lesion For the most part the data used are derived from a series of 24 cases of typical Osgood Schlatter disease which were seen personally by the author There were 40 lesions in these cases The source of other data is mentioned in the discussion The 24 cases were studied by interrogation, physical examination, and roentgen-ray examination

Many writers mention that rickets plays a role in the production of the lesion, yet in this series of cases there were none who had any of the cranial, thoracic, or long bone changes which follow rickets Likewise, the parents in nearly all cases stated that the patients had received anti-rachitic diets and medication in early infancy

In no case had there been an acute infectious disease preceding the onset of the lesion, except that one case had an acute respiratory infection 2 weeks before the beginning of trouble in the knee In 17 cases the tonsils and adenoids had been removed years prior to the onset It must be assumed then that neither

acute infectious diseases, respiratory infections, nor infected tonsils bear any relationship to the condition

Although all of these patients were asked specifically concerning pain in other areas of the body where osteochondroses are common, yet in no instance was there a patient who had ever had symptoms in these locations, and none had any physical evidence of such osteochondroses In this series it would seem that the lesion is unassociated with osteochondroses in other areas of the body

One patient was an obese person, another was undernourished, the remaining patients were of an average type, indicating that abnormal physical type had no bearing on these lesions

A familial or hereditary tendency does not appear established in the etiology of the lesion, as there were only 3 patients with a familial history and none with a hereditary history

Bursitis anterior to the tibial tubercle has been claimed by some to be the cause of the lesion Evidence that this is not true is presented by the dissimilarity of the roentgenogram of a bursitis and that of Osgood-Schlatter disease Figure 1, a, is a lateral roentgenogram in a case of bursitis, and Figure 1, b, is of a case of Osgood-Schlatter disease In the former the soft tissue swelling does not involve the tendon but lies anterior to it, extending to the skin shadow, while in the latter the swelling is entirely confined to the patellar tendon, the interval between the tendon and the skin showing no swelling This

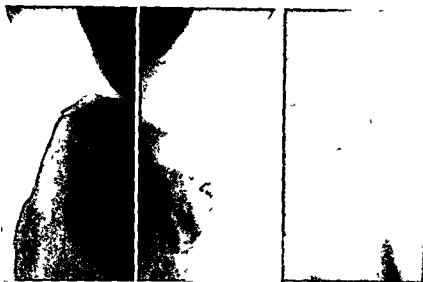


Fig 1 a

Fig 1, b

Fig 2

Fig 1 Roentgenograms illustrating the type of swelling in bursitis, a and of Osgood Schlatter's disease, b

Fig 2 The type of swelling anterior to the tibial tubercle in cellulitis

evidence, as well as the fact that in 12 tubercles operated upon there was no evidence of a bursitis would lead one to the conclusion that inflammation of the bursa anterior to the tibial tubercle is not a causative factor in this disease.

A local infection at the tubercle or in close proximity to it has been stated as the etiological factor. We fail to agree with this view. The roentgen ray appearance of such a lesion is unlike that of Osgood Schlatter disease. Figure 2 is a lateral roentgenogram of a case of cellulitis anterior to the tibial tubercle in a child. The soft tissue changes are entirely different from those found in Osgood Schlatter disease. There is no patellar involvement, nor are there any tubercle changes. In view of the dissimilarity of the roentgen ray appearance of these lesions and since there was not a positive wound culture of all lesions from which culture was taken we feel that local infection plays no part in the production of this disease.

ETIOLOGICAL FACTORS

Osgood Schlatter disease manifests itself at the age of puberty. This is the period of life when an individual's yearly increment in both ponderal and linear growth is the greatest. In

early childhood there is a rapid linear growth, which is followed by a period of slower growth after the age of 3 years. Near the age of 12 years—in females a little before this—there is again a period of very rapid linear and ponderal growth. This stage extends through adolescence.

Linear growth takes place mainly in the lower extremities, and, according to Digby the upper and lower femoral and the upper tibial epiphyses contribute $23\frac{1}{2}$ inches to the average complete linear growth of an individual. In comparison with the epiphyses in the upper extremity, those of the lower limb which have been mentioned grow more and at a much more rapid rate than do any other in the body and their most rapid growth takes place during the period of adolescence.

Muscle and tendon growth. Linear growth of a muscle which is already formed is a response to traction exerted upon its origin and insertion. In other words, the rate at which a given muscle grows is controlled by the rate of growth of the bones to which it is attached. The muscle becomes stretched by epiphyseal growth, lengthens accordingly, and keeps lengthening until epiphyseal growth has been completed.

A tendon which is already formed lengthens at the expense of muscular substance, whether it be from the muscle tissue or from the connective tissue elements of the muscle. In order to determine the extent of linear growth of the patellar tendon, the author selected lateral roentgenograms of the knees of 10 normal individuals, all of whom were at the age of adolescence, and on whom lateral roentgen-ray examinations were made covering a period from 1 to 7 years between the first and last examination. The manner of measuring these tendons is shown in Figure 3. The length of the tendon was measured from the lower tip of the patella to a point on a line erected perpendicular to the axis of the fibula at the most superior point of that bone. The distance between *E* and *F* in Figure 3 denotes the length of the tendon. The results of these measurements were as follows: There was a 3 millimeter increase in the length of the patellar tendon in one tendon in 5 years. The remaining tendons showed either no increase, less than 3 millimeters, or an actual decrease in length between the first and the last examinations. This would indicate that the patellar tendon does not lengthen, or lengthens an infinitesimal amount, during the active growth period. Linear growth of this muscle tendon complex must occur from the quadriceps muscle and quadriceps tendon.

The quadriceps muscle. This is one of the most powerful muscles in the body. Its origin is extensive, including the pelvis and a large portion of the surfaces of the femur. The area of origin is greatly out of proportion to the area of insertion, i.e., the tibial tubercle and expansions from the tendon to the tissue over and on either side of the tubercle. The muscle unit having the origin and insertion which it has is stimulated to grow in length by the three fast-growing epiphyses which have been mentioned. In response to their stimuli, the muscle tendon unit is placed in a greater degree of physiological tension during the age at which this disease appears than at any other period of life. The origin of the muscle is so extensive that tension is diffused, and therefore slight or no pathological process develops. The same tension is also transmitted to the area of insertion and, this being small, the

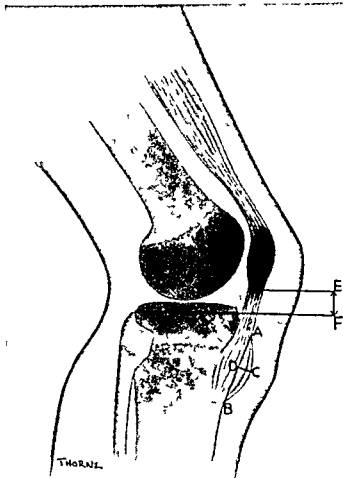


Fig. 3 Diagram illustrating the manner of measuring tendons used in this article

stress is great. Pathological changes may be produced in this structure and the tendon and its attachment thereby rendered more susceptible to injury.

Trauma. Direct trauma to the region of the tibial tubercle was claimed to be the initiating factor in 11 of 40 lesions studied. Indirect trauma, such as running, jumping, or excessive walking, was stated as a preceding factor in 8 lesions, while of 19 lesions the patients or parents were unable to relate any antecedent trauma. Two of the patients were unable to give an accurate account as to the presence of trauma.

The fact that many of these lesions were initiated by either direct or indirect trauma seems to indicate that this plays some rôle in the etiology of the disease, yet the percentage of lesions, 47 in this series, which appears with no known trauma would lead one to feel that



Fig 4, left Illustration of the tendon swelling the first roentgenological evidence of Osgood-Schlatter's disease right and swelling with calcification left



Fig 5 Later roentgenograms of the knees of the same patient shown in Figure 4 Large bone islands are present in either tendon

trauma is not the ultimate causative factor. Sixteen of the patients had bilateral lesions 66 per cent of the entire series. It is inconceivable that traumatism alleged to have caused the lesion in one knee would have affected the other knee at the same time in anything like this percentage of cases. This is strong evidence that the role of traumatism is to aggravate or call attention to the lesion rather than to produce it.

Significance of Hooke's law in Osgood-Schlatter disease. According to Hooke's law, Wertheim gives the moduli of a number of substances in grams weight per square centimeter. He states that elastic fibrous tissue, arteries and veins have a more marked decrease in strain stress than do substances such as bone or tendon tissue which are inelastic. Stresses which are applied by the quadriceps muscle will cause an initial damage to the elastic tissues of the tendinous attachment of the patellar tendon as well as the small vascular channels within the tendon and the attachment before damage takes place within the bone.

Blood supply to the tibial tubercle. Until the tibial tubercle has united with the diaphysis of the tibia its blood supply is furnished partly by the epiphysis of the tibia but to a greater extent by the overlying network of blood vessels supplied by the tissue of the

patellar tendon attachment. These blood vessels perforate the thin cortical substance of the tubercle. Little or no blood is supplied to the tubercle from the diaphysis of the tibia until after bony union between the two has taken place because the epiphyseal cartilage of the tubercle acts as a barrier.

If the patellar tendon and its attachment are altered from the normal, and if the blood vessels within these structures are changed, the tubercle of the tibia may be altered and the changes take place within the tendon which one generally ascribes to Osgood-Schlatter disease.

Seasonal influence on Osgood-Schlatter disease. A significant finding in the series of cases studied was the fact that in only one had the lesion manifested itself during the summer months of the year. Twelve patients stated that disability had started in the fall, and in 4 cases the onset of disability had been in the winter, while 4 other patients began to have trouble in the spring. Three patients were not able to give an accurate enough history as to the season of year when disability was first noted.

This striking seasonal influence on the onset of disability from this lesion might be explained by the fact that these patients are more active in the spring, summer and fall months, as well as that more rapid growth



Fig 6 a, Appearance of fragmentation which is often present in the tibial tubercle b, Disappearance of fragmentation with repair c, Repair complete

takes place in summer. The seasonal increase in growth and activity may be the basis for abnormal stresses which are placed upon the patellar tendon and which will gradually increase toward the fall. If a pathological process of the tendon is started it may be weeks or even months later that the child has symptoms.

ROENTGENOGRAPHY OF OSGOOD SCHLATTER DISEASE

Tendon enlargement. This is the earliest roentgenological finding in this disease. In Figure 4 are shown the lateral roentgenograms of a patient's knees. This patient, Case 1 in the series, entered the clinic at the age of 13 years complaining of pain over the tibial tubercles, of 3 years' duration. Neither direct nor indirect trauma had initiated these lesions. The roentgenogram shows enlargement of the tendon on either side but with no tubercle changes or calcifications within the tendon on the right. Neither of the tubercles was hooked. Figure 5 shows the same case 2 years later. The tubercles were slightly enlarged and there was a large bone island in each tendon. Each tendon still shows a marked degree of enlargement. Other similar roentgenograms could be shown to substantiate



ate the fact that tendon enlargement precedes other findings which are noted in roentgen-ray examination of this lesion. The fact that in many cases one is unable to elicit trauma as an initiating factor in the lesion indicates that the disease can occur without trauma, and may occur as the result of intensified physiological strains which are placed upon the tendon and its attachment. As will be mentioned later, the enlargement of the tendon is a constant feature in this lesion, and, also, the enlargement may involve the entire tendon.



Fig 9

Fig 10

Fig 9 Residual bone island and irregular tubercle resulting from Osgood Schlatter's disease

Fig 10 Pre operative roentgenograms of patient's knees from which specimens were taken, which are described in the article

and the tubercles have the appearance of fragmenting. Figure 6, b, shows the same knees 6 months later. The architecture of the tubercles has become more regular. Roentgenograms of the same lesions 5 years after the first were taken (Fig 6, c) show that the tubercles have united with the shaft of the tibia, the architecture of the tubercles is normal in appearance, and each tubercle is enlarged.

Ossification of the tibial tubercle is not essential in the formation of this disease, although in nearly all cases the tibial tubercles were ossifying. The patient in Case 4 in the series was a boy aged 12 when he entered the clinic for the first time. He had struck his right knee 3 weeks before admission. His complaint was pain about the tubercle. Later in the same year he started to have pain over the left tubercle. The trouble on this side had started gradually and without any obvious cause. Figure 7 shows the roentgen-rays of this patient's knees on admission, a, and two years later, b. The former shows a moderate amount of tendon enlargement on the right with slight calcifications within the tendon at its attachment, and the tubercle just starting to ossify. On the left the tubercle was not present, but there was slight tendon enlargement, an indication that the disease would eventually cause symptoms on this side. The later film shows the usual x-ray findings in both sides, and the tubercle has appeared on the left.

As a result of operative interference complete and permanent dissolution of the tibial tubercle can occur. The first case in the operative series illustrates this. The tendons on both sides were split longitudinally, drill holes were made through each tubercle to the tibial shaft, and bone pegs were placed within these holes. Figure 8, a, shows the lateral roentgenograms of this patient's knees before operation, while b, represents the roentgenograms 2 years later. In the latter the tubercle on the right has entirely disappeared, while the one of the left is quite regular and normal, and the degree of tendon enlargement can be seen to be lessened. This patient was entirely relieved of disability a few weeks after operation. The case not only proves that the tubercle can disappear as a result of operating but also indicates that the tubercle is not essential for the maintenance of normal function of the quadriceps muscle. A logical explanation of the dissolution of the tubercle in this case is that as a result of the operation circulation to the tubercle was altered.

Calcified and ossified islands. After enlargement within the patellar tendon has taken place, secondary changes may occur in the form of calcifications. After the small areas of calcification appear one is able, in later roentgenograms, to see ossification occurring where there was a previous island of calcification. In Figures 4 and 5 this is well illustrated. Figure 4 shows the enlargement of



Fig. 11 Photomicrograph showing the specimen taken from patient whose roentgenograms are shown in Figure 10. Specimen came from right side. $\times 8$

either patellar tendon with a small area of calcification on the left, and with neither calcification nor ossification on the right. Figure 5, a later roentgenogram shows large bone islands in both tendons, the one on the left occupying the position of the calcified area in Figure 4, while on the right a bone island is present where neither calcification nor ossification was visible before. Calcification in this lesion must have occurred as the result of pathological processes within the tendon. Following this these areas are converted to ossified islands.

Bone islands within the tendon may disappear but in some instances they remain. Figure 9 is a lateral roentgenogram of a patient, 24 years of age, in which one can see the large ossified islands as well as the marked irregularity of the tubercle. The patient had entered the clinic at the age of 16, when a clinical and roentgen ray diagnosis of bilateral Osgood Schlatter disease had been made. At this time only small calcified and ossified islands were noted by roentgen ray.

PATHOLOGY OF OSGOOD SCHLATTER DISEASE.

In the discussion of this phase of the disease three specimens will be described. Two of these specimens are from one individual, a boy

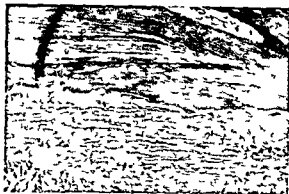


Fig. 12 Photomicrograph showing the tendinous attachment in the normal

of 15 years, who complained of trouble in both knees 8 months prior to the time operation was done. The onset of trouble was without any known trauma. Roentgenograms of this patient's knees are shown in Figure 10. On the left side the patellar tendon is enlarged and there is a small calcified area within the tendon near its attachment to the tibial tubercle. On the right side tendon enlargement is seen, and also a large bone island is present within the tendon. On the left side a sagittal section was removed in such a manner as to include the tendon, the tubercle, and its cartilage, and a portion of the diaphysis of the tibia. On the right side a section was removed including the bone island. Figure 11 shows the section taken on the right. Not only can the bone island be seen within the substance of the tendon, but it is entirely within the tendon. The tubercle is seen on the lower side of this specimen.

In Figure 12 is shown the manner in which the patellar tendon attaches to the tubercle in the normal. This specimen was removed from a patient aged 13 years. The tendon was composed of fibrous tissue arranged in an orderly manner, with the attachment to the tubercle being relatively smooth and regular. The tendon fibers were closely packed together, with few blood vessels in the substance of the tendon at the attachment to the tubercle. The number of cells was not increased above the normal of tendon tissue, and no fibrocartilaginous areas were present within the tendon or at the attachment.



Fig 13

Fig 13 Cartilaginous areas within the tendon, A Note the irregularity of tendon fibers X82

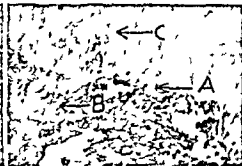


Fig 14

Fig 14 The junction of the tendon with the tubercle in a case of Osgood Schlatter's disease A, Denotes the junction, B, the cellular bone of the tubercle and, C, the



Fig 15

notes the area of fibrocartilage described in the article X82

Fig 15 A photomicrograph of a portion of the bone island shown in Figure 11 Area of calcified cartilage, A and fibrocartilaginous ring about bone island, B X82

In the case of Osgood-Schlatter disease the tendon fibers are arranged rather loosely and with spaces between fibers and with areas of fibrocartilage within the substance of the tendon, as is shown in the photomicrograph illustrated in Figure 13. The degree of vascularity within the tendon itself is also moderately increased.

The attachment of the tendon to the tubercle is very irregular, and, instead of tendon fibers passing directly to the tubercle as is seen in the normal, there is an area of fibrocartilage between the tendon and the tubercle. This might account for the increase in size of the tubercles in this disease as later this cartilage becomes ossified. There is a marked increase of cells at the attachment of this fibrocartilage with the tubercle as is illustrated in Figure 14, and plasma cells, lymphocytes and young fibroblasts are present. There is a great increase in the degree of vascularity at the junction of the cartilage with the tubercle.

As has been mentioned before, the islands one sees in this lesion are within the tendon. Microscopically the bone constituting these islands is more cellular than normal bone. About the margins of the bone itself there is a definite zone of fibrocartilage as can be seen in Figure 15, from which the bone is being formed. The tendon about the area of fibrocartilage is very vascular and cellular. Near the bone island, in one place, an island of fibrocartilaginous cells was found, in the matrix of which the presence of calcification was noted (Fig 15).

CLINICAL STUDY

One hundred and thirty-six patients with Osgood-Schlatter disease entered this clinic between the years 1923 and 1933. Twenty-four of these patients with admission and follow-up roentgenograms, were seen by the author. Twenty-two of these patients were males and 2 were females. The average age on admission of the former was 13, the eldest being 19 and the youngest 10. The 2 females were aged 10 and 11 on admission. Of the entire series of patients with this disease seen at this clinic nearly all the females were much younger than the males. This fact might be explained by the more rapid increase in linear growth in females, thus leading to the presence of the lesion at an earlier age in females.

The symptoms complained of by patients suffering from this lesion are well known. Pain over the tibial tubercle when walking, with an increase of pain on running or climbing stairs, is one of the most constant symptoms. Perhaps the most important symptom is the disability which these patients experience when they endeavor to carry on athletic activities. The degree of athletic activity was not severely limited by symptoms in any of the cases of this series. Moderate limitation was complained of by 16 patients, while 4 patients were slightly handicapped, and 2 had no limitation. Two patients were limited in activities as a result of residual paralysis, due to poliomyelitis of the opposite extremity rather than to the lesion in the sound limb. The percentage of patients with Osgood-Schlatter disease and with paralysis of the

opposite extremity is relatively high in this small group; however, these 2 cases are the only patients with the two conditions in the entire number of patients with Osgood-Schlatter disease who came to the clinic for treatment.

In 16 patients there were bilateral lesions and 8 patients had unilateral involvement.

TREATMENT

Nineteen of the patients were treated by various conservative measures which consisted for the most part of daily massage of the affected region, limitation of activities and partial immobilization of the knee by ace bandages. In no case was a cast used in treating these patients.

Five of the patients were operated upon and to these are added 4 others not seen personally by the author. In the 9 operative cases 12 tubercles were operated upon. In 8 of these the tendon was split in a longitudinal manner reflected to both sides of the tibial tubercle and drilling into the tibial diaphysis was done. In 4 tubercles the tendon was not reflected, the drill holes being made into the tubercle through small slits in the tendon. In 4 instances the tubercles were pegged by placing small bone chips in the drill holes. These chips were removed from the shaft of the tibia. All wounds were closed in layers with plain gut sutures to the deep tissues and running silk sutures to the skin. Dry dressings and flannel pressure bandages were applied to the operative area.

Sutures were removed from the wounds in 10 days. The patients were allowed up as soon as the sutures had been removed and they were discharged from the wards 2 to 3 weeks after operation. In no case was there any post-operative complication. Daily massage of the affected area was begun as soon as sutures had been removed and the patients were started on active knee motion at the same time.

CLINICAL FOLLOW UP

The average follow up period in the non-operative group of cases was 5 years, the shortest period being 3 years and the longest 10. Twelve of the patients were entirely free

from trouble when they were seen in follow-up clinic. The average age when disability had entirely disappeared was 14. The average interval from the time when these patients started to have symptoms until they were entirely relieved was 2 years and 3 months. The longest period of disability was 4½ years and the shortest was 7 months. Seven of the patients still had symptoms due to the lesion when last seen. The symptoms were very mild usually being pain over the tubercle on kneeling or pain in the same area in strenuous activity. Two of these patients were in their early twenties, 2 in their late teens and 3 were 15 years of age.

In the operative group of cases the average follow up period was nearly 3 years, the longest period being 5 years and the shortest 1 year. Seven of these 9 patients were entirely free from any symptom and the interval of time between operation and complete relief was from 4 to 6 weeks. Two patients continued to have disability of the same type as before operation 1 of them 2 years, the other 1 year after operation. Both of these patients were 16 years of age when last seen. In both cases drilling and bone-pegging had been done. In one instance the tubercle had been drilled through small slits in the patellar tendon and in the other a long longitudinal split of the tendon had been done.

ROENTGENOLOGICAL DATA OF CASES STUDIED

Non-operative series. The tubercle of the tibia may be of varying degrees of enlargement following this lesion and in some cases there is no appreciable enlargement. Five tubercles in the non-operative group of 11 were not enlarged roentgenographically on follow-up examination 1, showed a moderate degree of enlargement, 6 were slightly enlarged. Two tubercles, poliomyelitis patients, are not included. Eighteen tubercles had united with the tibial shaft when seen on follow-up examination, the remaining tubercles had not united. Two patients with ununited tubercles still had trouble in the region of the tubercle, the remaining cases in which the tubercles had not united were free of symptoms. This illustrates the fact that union of the tubercle with the tibial shaft is

not essential for the relief of symptoms. Conversely, the fact that 5 patients whose tubercles had united with the shaft still had symptoms would indicate that union of the tubercle with the shaft does not cause relief of symptoms.

Calcified or ossified areas were present in 19 non operative tendons on admission to the clinic. In follow-up roentgenograms there were 25 tendons showing these islands. A bone island was present in one tendon in the admission roentgenogram but had disappeared when the last roentgenogram was taken. Four tendons were without either calcified or ossified areas in both admission and follow-up roentgenograms.

Thirteen tubercles had the appearance of fragmenting in their first roentgenograms, while on the last examination none had this appearance.

All operative cases. Eight tubercles of the 12 which were operated upon were slightly enlarged, as indicated by the first roentgenograms. Nine of these were slightly enlarged in follow-up roentgenograms, 1 was severely enlarged and 1 moderately. One tubercle operated upon showed no degree of enlargement. This would indicate that operative work has little effect upon the future size of the tubercle.

Seven of the 12 tubercles had united with the tibial shaft in follow-up roentgenograms. Four tubercles had not united with the shaft, while one tubercle had been entirely absorbed. Two of these patients had symptoms on follow-up examination. Many of the operative cases had roentgenograms taken at periods following their operations. In them the tibial tubercle did not unite with the shaft for many months and sometimes years. This, coupled with the fact that many patients were relieved in such a short period after operation, leads one to the conclusion that union of the tibial tubercle with the tibial shaft is not necessary for the relief of patients suffering from this disease.

Calcified or ossified islands in the tendon were a feature in 6 cases before operation, and at the last examination of these patients 10 tendons showed areas of ossification. It appears, therefore, that drilling and pegging of

these tubercles has no effect upon the disappearance of these islands, nor do the islands give symptoms, since many patients with them were without symptoms after being operated upon.

TENDON CHANGES

The manner of measuring the patellar tendons is illustrated in Figure 3. Two places for measuring the total diameter of the tendon were taken. One place was immediately below the lower pole of the patella, and the other was at the superior margin of the tibia, or at *A* in Figure 3. In discussing these measurements the former will be spoken of as the patellar measurement, and the latter will be called the tibial measurement, of the tendon. In order to determine the amount of enlargement in the anterior part of the tendon a point, *A*, was taken on the proximal anterior surface of the tendon where it was of uniform diameter. Another point, *B*, was taken anterior to the shaft of the tibia where the tendon faded into the covering membrane of that bone. These two points were connected by a straight line. The distance *D-C*, from a point on the line to the anterior surface of the tendon, was measured. This denoted the maximum swelling of the anterior portion of the tendon, and will be spoken of as tendon swelling in the discussion.

A series of 25 normal tendons was measured in the same manner. In this series the ages of the patients ranged from 8 to 19, a fairly representative series corresponding with the age at which this disease appears.

Normal series. The average diameter of the patellar tendon, or the patellar measurement, was 5.7 millimeters. The narrowest tendon at this point was 3 millimeters and the greatest was 9. The average diameter of the tendon at the tibia, or the tibial measurement, was 5.7 millimeters. The smallest and largest diameters were the same as for the patellar measurement. There was no tendon swelling anterior to the line *A-B* in 20 cases. In 2 there was 2 millimeters of swelling, in 2 others 1 millimeter of swelling, and 1 had 3 millimeters of swelling.

Non-operative series. The average admission diameter of the patellar tendon at the

patella was 7 millimeters, the minimum being 4, and the maximum 11 millimeters. The average diameter at the tibia was 8.5 millimeters, with a maximum diameter of 15, and a minimum of 5 millimeters. The average tendon swelling anteriorly was 6 millimeters, the minimum being 2, and the maximum 9.

In follow up roentgenograms the average diameter of the tendon at the patella was 7 millimeters, and at the tibia it was 6. The average amount of tendon swelling was 5 millimeters.

Operative series. The pre-operative measurements of this group were nearly the same as those of the non-operative series. The average patellar diameter for this group in follow up roentgenograms, was 9 millimeters, and at the tibia the average diameter was 9. The average tendon swelling was 8 millimeters.

The above data indicate that the patellar tendon retains a degree of enlargement throughout its entire extent after the symptoms of the disease have subsided. There are, however, some tendons which return to a normal diameter. All of the operative tendons increased in diameter after operation.

SUMMARY

The relief of symptoms in series of cases by other observers who have operated upon these lesions has been attributed to the fact that the tubercles, by drilling and pegging, unite with the tibial shaft by premature bony or fibrous union. It has been proved by this series that premature bony union does not take place as a result of such operative procedures, as well as by the fact that a few patients were relieved of trouble without operation and before bony union could have occurred. A fibrous tissue union with the diaphysis of the tibia is also an illogical explanation of the manner of relief after these patients are operated upon. The small amount of fibrous tissue which might conceivably form within the drill holes would hardly be sufficient to anchor the tubercle if separation had occurred. Also, the fact that in many non-operative cases relief is secured by conservative means is evidence that this type of union does not occur. Another proof

that premature union of the tibial tubercle is not a necessary procedure in relieving these patients is demonstrated by the fact that in one case of this series the tubercle entirely disappeared in a few months after operation, and yet this patient was relieved of trouble in a few weeks.

It is our feeling that the symptoms of which these patients complain are due to a swelling of the patellar tendon and its attachment. The pathological processes which cause this swelling have been mentioned. By splitting the peritenon and incising the tendon, intra-tendinous pressure is released. The tendon is thereby able to bulge through the incision, and the pain which is caused by increased pressure within the tendon is relieved, much in the same manner as pain is relieved when one incises an abscess.

Since this article was written three patellar tendons were split in two patients suffering from this disease. A complete description of these cases will not be given here but will be reported when more cases have been added to them. The two patients were discharged 2 weeks after operation and on their first visit to the clinic, 3 weeks after operation, they had no tenderness over the tibial tubercle, they carried on a normal life, and were entirely free of the disability present before they received treatment.

CONCLUSIONS

1. Rapid growth during adolescence is the underlying cause of Osgood Schlatter disease.

2. During the period of rapid growth the quadriceps muscle is placed under greater physiological strain than at any other period of life. This increase of strain may produce changes within the patellar tendon which can be recognized roentgenographically. The tibial tubercle can be altered by these changes within the tendon because the blood supply to that structure is changed. The roentgenographic appearance of the tibial tubercle in Osgood Schlatter disease is based upon the altered circulation within the patellar tendon and its attachment.

3. Fibrocartilaginous areas appear in the patellar tendon in this disease, and they are the result of traumatism within the tendon.

These areas become calcified and later ossified, and these changes can be seen roentgenographically

4 The disability experienced by patients with this disease is due to an increase in intra-tendinous pressure Release of this pressure by *slitting the tendon* will relieve the individual If conservative treatment is maintained the peritenon adapts itself to the increased size of the tendon and eventually disability disappears

5 Conservative measures should be used in treating patients seen in the late stage of the disease Slitting of the tendon is advised if patient is seen near onset of the disease

BIBLIOGRAPHY

- 1 BERKSON, J Evidence of seasonal cycle in human growth *Human Biol*, 1930, 2 521-518
- 2 BURNS DAVID An Introduction to Biophysics 2d ed New York Macmillan Co, 19 9
- 3 DIGBY K H The measurements of diaphyseal growth in proximal and distal directions *J Anat*, 1916, 50 187
- 4 HAINES R and WHEELER, M H The laws of muscle and tendon growth *J Anat*, 1932, 66 578-585
- 5 HARRIS J A JACKSON, C M, PATERNON D G, and SAMMO R I The Measurement of Man Minneapolis University of Minnesota Press 1910
- 6 OSGOOD R B Lesions of the tibial tubercle occurring during adolescence *Boston M & S J*, 1903, 146 114-117
- 7 SCHLATTER C Incomplete tear fractures of the tibial tuberosity or growth abnormality? *Heute z klin Chir* 1908, 59 518-546

ACUTE APPENDICITIS WITH PERITONITIS

Treatment and Mortality

FREDERICK C. HERRICK, M.D., F.A.C.S., Cleveland, Ohio

THE desire to contribute to the clinical care of serious cases of acute appendicitis with peritonitis, to describe the methods whereby a low mortality has been gained and to discuss other general surgical factors contributing to mortality percentage has prompted this discussion.

When we realize that a long known well understood, diagnosable, localized disease treated by recognized methods and curable, still carries a death rate of 15.2 per 100,000 of population—that rate being nearly doubled in the past 20 years—we must search for the cause of this mortality. Add to this the fact that, in cases with peritonitis, there is an operative mortality of 5 to 30 per cent for which the surgeon must accept a large part of the criticism we ask ourselves, where is the trouble?

In a case of abdominal pain, not only the laity but too frequently the physician suggests delay, catharsis, and the use of morphine—the arch enemies of the patient and when finally the patient reaches the hospital after a late diagnosis of acute appendicitis with peritonitis, a resident or junior inexperienced visitant too often is assigned to the case. An abdominal pain should be considered appendicitis until otherwise proved and the most experienced surgeon available should operate unless another well trained in his methods is available. J. M. F. Finney, Jr., produced statistics to show that the mortality in acute appendicitis complicated by peritonitis when handled by visiting surgeons was practically the same as that when the operations were done by residents. It seems to me that Finney's mortality rate as reported is too high and is the result of a wrong conception of treatment by both visitants and residents. When a surgeon opens the abdomen on any diagnosis he should have the training to meet any condition found. If as Finney concludes,

an incompletely trained surgeon can handle acute appendicitis with as low a mortality as that of the experienced surgeon, why all the painstaking methods to train surgeons and why should 3 to 7 or 8 years be required in such a training if the mortality and operative results in such a disease are not improved? Being thus burdened with principles, I operated upon the patient or closely supervised operation in every case of this series.

Group statistics determine general results only, it is necessary to study uniform individual methods practiced by an individual surgeon in order to appreciate results. The operation itself, although it may ruin the patient's chances, may still be but a part of the cause of mortality and any one of the three stages—diagnosis, operation, and postoperative care—may improve or ruin the results. Each surgeon may plan his technique, partly from group statistics, but, as in the present problem, he must have as well his own well grounded conceptions of pathology, diagnosis, course and treatment.

In the period from 1913 to 1923, the author treated in Cleveland City Hospital 156 patients with appendicitis with gangrenous or ruptured appendices, patients with well marked peritonitis requiring drainage. This hospital had, at that time a capacity of about 1000 beds and received the usual run of patients with advanced or neglected disease who go to such institutions. In the histories there were commonly mentioned not only delay but the use of catharsis and morphine. This series included all such patients admitted during the same 4 winter months for 10 years, thus making a good cross cut of appendicitis occurrence and removing the factor of a favorable series. The group includes all serious cases of acute appendicitis with peritonitis requiring drainage, but it does not include the large number of cases of acute appendicitis not requiring drainage, or subacute or recur

ring appendicitis, or cases in which appendectomy was done during an abdominal operation for other causes. In these so called clean appendectomies, there were no deaths due to the operation.

During this period in 4 other hospitals, there were in the author's service 61 of the same class of cases, making a total of 217 cases of acute appendicitis with peritonitis requiring drainage. In these two groups totaling 217 cases, there were 5 deaths, a mortality of 1.84 per cent.

Closure of the abdomen in the presence of pus with peritonitis, in our judgment, is bad surgery, so that this series includes no such case but only those in which our judgment dictated drainage.

How have the results in this series of cases been gained? In a search for the causes of the higher mortality, some simple surgical principle may inadvertently be overlooked. For this reason, early in our practice we adopted certain rules of procedure.

Immediate operation in every case on the diagnosis of appendicitis. No possible excuse—professional, social, holiday, or other engagement—was permitted to break this rule. At times this has resulted in some privations, but it has been followed. We are well aware of the old Ochsner treatment: delay in certain advanced cases to permit the localization or walling off of an abscess or the building up of immunity, the excuse that the patient is not suitable for operation or that other diseases may be present, the question of age and intercurrent disease. We have come to believe that such factors are negligible and that operation should be done at once on diagnosis. In some cases, simple incision and drainage may be all that is indicated but immediate operation is the procedure of choice. Local anesthesia, infusions of salt solution before, during, and after operation together with the Alonzo Clark postoperative care make immediate operation in all cases the safest procedure. Delay is common enough before these patients are seen by a competent surgeon. Why should the surgeon delay still further? While the practitioner or consultant has his attention focused to find the relatively few cases which he considers as suitable for late operation, delay be-

comes the custom and the fatal complications develop. A questionable delay held as best in a few cases further *jeopardizes the many*. Again those few patients, say 10 per cent, in which it is claimed delay in operation will enable resistance to develop or walling off to occur, will not be harmed but will be benefited by an accurate, non-shock producing operative procedure which, with the slightest trauma, relieves the source of peritoneal infection.

TECHNIQUE

Anesthesia Nitrous oxide gas and oxygen with ether if necessary has been the routine anesthesia. In toxic cases and in those complicated by other serious disease, e.g., pneumonia, heart conditions, local anesthesia by block and infiltration has been used.

Routine A ruptured appendix may present one of the most difficult, nice operations of the abdomen. Localization and access to the appendix, prevention of contamination of loops of small gut, non-disturbance of the gut, delivery of the appendix without rupture or further spread of infection, when, how, and what to use as drainage, respect for the peritoneum, the non-disturbance of intraperitoneal pressure—all these steps present their problems. The delegation of a "pus appendix" to any but the best experienced available surgeon is wrong, yet this is too frequently the custom. Familiarity breeds contempt.

A saline infusion, either subcutaneously or intravenously of 1000 to 1500 cubic centimeters was given to adults (children in proportion) before or during operation. A short, 3 inch or less, intermuscular incision was made. The old practice of walling off with gauze tapes or rubber dam we have never practiced since it seems perfectly obvious that pus and infection are thereby carried into the areas we wish to protect and thus brought into contact with loops of small gut. Likewise bulging of loops of small gut into the wound was prevented, possibly by having a very few inches of gauze always visible in the wound. Through the small incision pus or seropus escapes or is sucked. The cecum or loop of small gut tends to present into the wound, thus partially closing the peritoneal cavity without changing the normal intra abdominal pressure. Inspec-

tion or exploration is never attempted. Knowing that about 66 per cent of appendices are retrocecal or retrocolic, the surgeon passes the exploring index finger first lateral to the cecum where in these cases it encounters the familiar feel of the thickened appendix and inflammatory tissue, or he guides the finger along the trough over the iliac vessels where the pelvic appendix is found in 31 per cent of cases. In both situations the cecum is displaced toward the midline, the appendiceal mesentery and appendix being carefully handled. Rough handling of the appendix or cecum does not occur and the danger of pyle phlebitis is prevented. Thus we have neither earned infection elsewhere nor sought to determine the extent of the peritonitis. If we are able to state accurately that a general peritonitis is present we have markedly reduced the patient's chance of recovery.

The appendix may be simply ligated or preferably by means of a double purse string suture, inverted if the condition permits but never both. In one early case of simple appendicitis not here included, in which *ligation and pursestring suture* were both practiced, an abscess developed between the ligation and the inversion and required a secondary operation. In 4 cases only, the appendix was not removed. When a ruptured appendix is left and drainage is established there is a constant potential or active reinfection of the local peritoneum which contributes to extension of the peritonitis.

Drainage. A very old problem. What is gained by closure of the abdomen based purely upon unsubstantiated theories of peritoneal resistance, except a risk? Recent statistics by Bruer, covering a very large group—1000 cases of appendicitis with peritonitis closed without drainage—still gives a mortality too high for such cases. Limitation of the extension of infection by drainage seems always indicated. Reverse lymph flow of whatever duration (Horsley) aids in such an elimination. If the lymph current is reversed, as when stimulated by a foreign body, better elimination occurs and better localization. At least until there is available an efficient peritonitic serum or vaccine the peritoneal abscess should be drained as any other abscess. While we are

studying by clinical experience the possibilities and in what conditions the peritoneum may be closed, the general mortality goes up. It has been our custom to drain¹ in all such cases. A drain is always placed deep into the pelvis. One may also be placed to the stump of the appendix or retrocecal, or, in the worst cases, on the left side into the pelvis. Care should be exercised that the drain does not press upon the large vessels, ureter, or loop of gut. Erosion of vessels (2), vein (1), artery (1), tube on a loop of small gut (1), have been seen. Cigarette drains and rubber tissue, easily collapsible by muscle or suture pressure, are worthless, if evacuation is desired. I have seen an instance of fatal residual abscess due to a cigarette drain acting as a plug. Reasoning that a drained cavity becomes walled off within 24 to 36 hours and that therefore the drain may be safely removed, several times after removal of a drain we have seen the abdominal wall and its seal thus causing a residual abscess requiring drainage. Therefore until the temperature has touched normal and the patient is out of danger we leave in all drains, loosening or shortening them from time to time.

Drainage of peritoneal abscess. It seems entirely unreasonable to leave a collection of pus or seropurulent fluid in any part of the peritoneal cavity no matter what are the apparent resistance of the patient and the absorptive power of the peritoneum. The patient's resistance may be high. Why not use it as an advantage instead of an experimental attempt to find out how much he can resist if the peritoneum is closed? A fluid collection may become walled off, may become purulent, may form a focus for lymphatic extension, venous thrombosis and extension, may very greatly increase in volume even to filling the left peritoneal fossa to above the navel as seen in a child of 7 years.

Postoperative care. The postoperative care begins even before operation. Intravenous saline glucose infusions of 1000 to 2000 cubic centimeters and morphine to the physiologic limit in one or two doses if there is unavoidable delay before operation are given.

¹The ideal drain consists of a 1 centimeter notched soft rubber tube with a lower wick of gauze through it which gives both capillarity and tube space.

Pitressin has given sufficiently good results and is on a sufficiently proved basis to be used both before and after operation in selected cases. After operation nothing is given by mouth, but intravenous saline or saline and glucose, 4000 to 6000 cubic centimeters is given, every 24 hours, morphine is administered until respirations are 14 to 16 and the pupils are moderately contracted, gastric or duodenal lavage is used following vomiting or regurgitation—these procedures together with extreme vigilance and frequent observations to detect the first signs of trouble, constitute the invariable treatment.

My attention has occasionally been called by the resident to a rapid pulse, anxious facial expression, and abdominal distention as evidences of an extending peritonitis. Regurgitant type of vomiting, a little brownish stain to a handkerchief, to the corner of the patient's mouth or on the bed sheet, together with epigastric distention, tell the often overlooked story of fluid intake by mouth and a gastric dilatation which, if repeated lavage or continuous evacuation of gastric content is not carried out by a retained tube, may prove fatal.

Morphine without atropine results in a contracted tubular type of gut, it lessens or obliterates peristaltic waves (Sollmann), and through intestinal muscle contraction it gives support to and lessens the volume of the intestinal circulation. Morphine, therefore, prevents intestinal circular muscle relaxation, vascular dilatation, increased blood supply, and increased retention of blood in the intestinal capillaries. Increased blood content of the intestines results in diffusion of the blood gases into the gut with greater distention. The gas producing group of organisms adds to this distention. It has been shown that this intestinal gas has about the same carbon dioxide content as has expired air, hence the gut, in a condition of paralytic obstruction, acts in the nature of an expiratory organ. At the same time, with this increased blood content, the toxins of obstruction which are the result of putrefaction of the intestinal content pass more freely into the circulation, thus furnishing the lethal toxemia of obstruction.

Whether these toxins originate from micro-

organisms or from the intestinal contents as maintained by Brooks *et al*, whether they originate from faulty intestinal digestion or from intramucosal intestinal origin as maintained by Whipple *et al*, or whether they are the result of dehydration, is immaterial except as the origin affects the ultimate production of a serum. It is evident clinically that the typical toxemia is not apparent when there is no paralytic dilatation of the gut, when the gut is contracted as a result of morphine administration the toxemia of paralytic obstruction does not occur. In local peritonitis, when the gut is contracted and its vascular supply is lowered, there is but one group of toxins to combat, i.e., those coming from the peritonitis. Therefore, before operation and immediately after operation, it is of great assistance if one can be assured of a contracted gut. If this pre-operative and postoperative status has not been established, if there is present or there has developed a paralytic type of stasis of the gut with a toxemia of intra intestinal origin as well as a toxemia of peritonitis, the outlook is grave.

In these difficult borderline cases in which the patient hovers between recovery and death, complications may often be foreseen and prevented if the physiological processes as affecting the patient in question are kept in mind. Observations as to the volume intake and output of fluids—bearing in mind the amount of excretion necessary to eliminate a heavy toxemia—as to the conditions of renal excretion, as to the cardiovascular circulatory balance as to respiratory conditions, as to blood chemistry and consultation when problems as to heart, blood, and respiration arise, will keep the clinician alert to changing conditions of the patient. Quick appreciation of the dry tongue and skin, the rapid pulse, the lessening of elimination, the distention, the restless discomfort, as well as many other indications to which the practicing physician, familiar with the physiological phase of medicine is aware, will often turn the trend to recovery.

OTHER CAUSES OF MORTALITY

During the years between 1910 and 1930, approximately, there developed in the surgical

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF MINNESOTA

HEMOSTASIS IN THYROIDECTOMY

MARTIN NORDI AND, M D, Minneapolis, Minnesota

UNLIKE the surgical treatment of most structures, the surgical management of the thyroid gland is not concerned alone with a low mortality rate but because of its rich blood supply it is also seriously concerned with the problem of hemostasis. The operative mortality in thyroid surgery is accepted at the present time as less than 1 per cent. This low rate is obtained whether the surgeon proceeds without any plan, excising the gland as he would any other tumor and ligating the vessels as they bleed, or whether he follows a careful technique based on the anatomy involved. The thyroid surgeon, however, must obtain a good functional and cosmetic result as well as avoid technical complications, such as injuries to the laryngeal nerves, parathyroid bodies, and the occurrence of hemorrhage. A technique aimed mainly at hemostasis will best accomplish this end because injury to the laryngeal nerves and parathyroid bodies occurs probably most often in the attempt to apply ligatures to the thyroid arteries and in the attempt to control hemorrhage which occurs within the capsule.

The incision for thyroidectomy should be relatively straight and in patients with ordinary sized goiters it should be placed about one finger breadth above the upper border of the sternal ends of the clavicles (Fig 1). In the patients with larger goiters, because of the resulting looseness of the skin, the incision should be relatively higher to prevent "dropping" of the scar onto the upper chest. The incision should go down to, and through the superficial layer of the deep cervical fascia thereby including the anterior jugular veins which are dissected back with the anterior flap. After the bleeding in the upper flap has been controlled, the lower margin of the wound is undermined for a distance of about 2 centimeters. This important procedure prevents an "overhanging" of the skin of the upper flap after operation. Inclusion of the superficial layer of the deep cervical fascia in the flap has the advantage of preventing ecchymosis of the skin in the thin patient and when the prethyroid muscles have

been thus exposed without their fascial investments, they can readily be retracted without cutting (Fig 2 A).

While ligation of the inferior thyroid artery may be accomplished within the thyroid space during or after the removal of the gland, we have followed the teaching of deQuervain and apply a ligature to the inferior thyroid artery before proceeding to an excision of the gland. The median border of the sternomastoid muscle is freed and drawn outward with a blunt retractor. The exposed fascia of the prethyroid muscle is now slit vertically for about 3 centimeters (Fig 2 A). The outer edge of the slit fascia is pared back gently and the finger is gently slipped down through the areolar tissue mesial to the carotid sheath to the transverse processes of the vertebra. The inferior thyroid artery is readily felt at the level of the sixth cervical vertebra (usually marked by a small tubercle), as it emerges at right angles to the carotid sheath. Exposure is quickly accomplished by placing retractors into the depth, with the outer retractor including the sternomastoid muscle, the carotid artery, vagus nerve, and jugular vein and the mesial retractor holding the prethyroid muscles and the thyroid mass (Fig 2 B and C and Fig 3). The inferior thyroid artery is lifted from the prevertebral fascia with a blunt dissector and a linen suture is readily applied (Fig 3), and at this stage of the operation the retractors removed.

In the ligation of the inferior thyroid artery, during or after the process of resection, the ligature is seldom applied to the trunk of the artery, but more often to one of its branches, thereby endangering the recurrent laryngeal nerve (Fig 5) and naturally producing less hemostasis. Preliminary ligation of the inferior thyroid artery effects better hemostasis, which together with the more distant application of the ligature, offers greater safety to the recurrent laryngeal nerves and parathyroid bodies.

The retractors having been removed, the excision of the gland is begun through the median separation of the prethyroid muscles. Since the

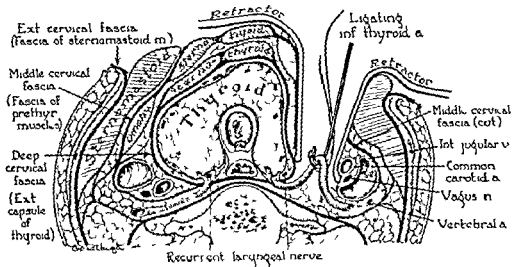


Fig 3

sutured, the wound is held widely open and the patient is asked to strain. When the resection is done under gas anesthesia the patient is awakened sufficiently to cause automatic straining. This will expose any hidden bleeding which is cared for at once. Two "pants drains" (split tube) are placed down to the thyroid space through holes pierced in the fascia of the lower flap (Fig 7 A) and the superficial layer of the deep cervical fascia is closed with interrupted plain catgut

(Fig 7 B). A running suture of fine plain catgut is placed in the platysma to approximate the skin margins, and the skin is closed with interrupted dermal suture and clips. For a good scar (a very important part of the operation) the clips, tubes, and dermal suture should be removed early.

Stage operations still have a place in the surgery of the thyroid in spite of the employment of iodine in the preparation of patients with hyperthyroidism. Ligation of the superior thyroid

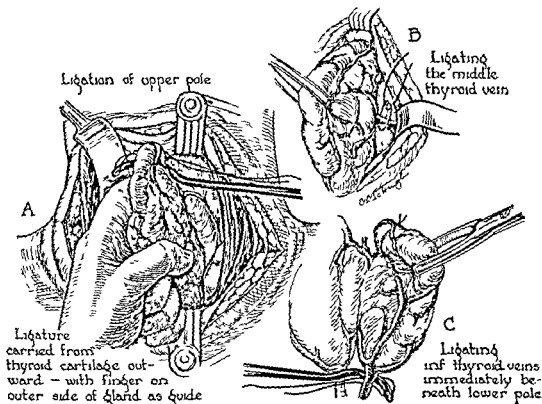


Fig 4

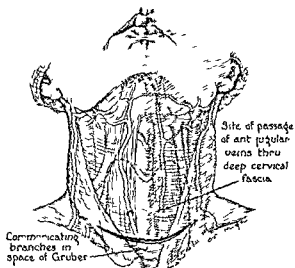


Fig. 1 Collar incision through skin and fascia of prethyroid muscles

superficial layer of the deep cervical fascia has been dissected back with the anterior flap, it is possible to get sufficient exposure for excision of the smaller glands with the median separation of the prethyroid muscles. In the large glands, it is advisable not to stretch these muscles too far since they tear easily. In such cases cutting of the muscles between clamps is best for good exposure. Before mobilizing the lobe it is well

after grasping it firmly with the tenaculum, to apply ligatures or clamps to the middle thyroid vein (Fig 4 B) and cutting between. With this vein bisected, mobilization is more complete. The superior pole is next ligated by passing a carrier from within outward to include the pole *en masse* or the artery alone as desired. The ligature must pass around the whole pole and not through it (Fig 4 A). A similar ligature is applied to the inferior thyroid veins immediately beneath the lower pole (Fig 4 C). When this has been accomplished with both lobes, preliminary ligatures have been applied, as illustrated in Figure 5, to (1) the inferior thyroid arteries "extrafascially," (2) the superior thyroid arteries and veins, (3) the middle and (4) inferior thyroid veins. The gland can now be resected deliberately with very little bleeding.

Each lobe when resected is held firmly in the tenaculum and clamps are applied to the capsule (Fig 6 A) to mark the site of the incision before the removal of the gland. During the resection it is well to have the assistant hold a finger under the outer row of forceps. This assists in the control of bleeding and more thoroughly everts the entire lobe for a clean dissection. Interrupted sutures of plain catgut are used to close the stump (Fig 6 B). When there is a large median lobe present, it is resected the same as a lateral lobe or included in the resection of one of the other lobes. After the capsule of both lobes has been

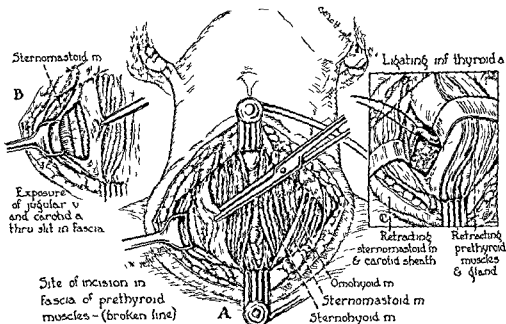


Fig. 2

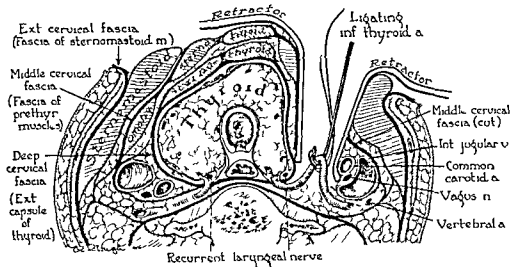


Fig 3

sutured, the wound is held widely open and the patient is asked to strain. When the resection is done under gas anesthesia the patient is awakened sufficiently to cause automatic straining. This will expose any hidden bleeding which is cared for at once. Two "pants drains" (split tube) are placed down to the thyroid space through holes pierced in the fascia of the lower flap (Fig 7 A) and the superficial layer of the deep cervical fascia is closed with interrupted plain catgut

(Fig 7 B). A running suture of fine plain catgut is placed in the platysma to approximate the skin margins, and the skin is closed with interrupted dermal suture and clips. For a good scar (a very important part of the operation) the clips, tubes, and dermal suture should be removed early.

Stage operations still have a place in the surgery of the thyroid in spite of the employment of iodine in the preparation of patients with hyperthyroidism. Ligation of the superior thyroid

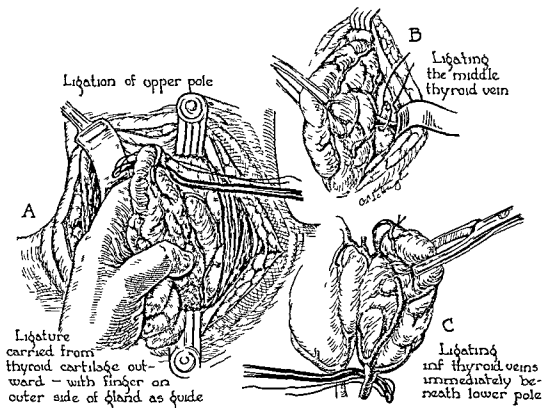


Fig 4

TABLE I — ANALYSIS OF CASES

Data	Under 48 hrs		48-72 hours		72-96 hours		96-120 hours		120 hrs 7 days		8-10 days		Over 10 days		Total	
Number of cases	6		6		4		6		10		17		32		90	
Average age	48		55		46		52		42		45		48		47	
Average temperature	100.5		100.6		99.9		102.6		100.6		100.5		100.5		100.6	
Average leucocyte count	16,500		20,300		20,100		17,700		18,800		14,600		17,400		16,800	
	No	Per cent	No	Per cent	No	Per cent	No	Per cent	No	Per cent	No	Per cent	No	Per cent	No	Per cent
Palpable mass	1	17	1	17			6	100	9	47	9	50	15	47	41	46
Operative procedure																
Cholecystostomy	5	83	6	100	3	75	6	100	13	69	9	54	10	31	52	58
Cholecystectomy					1	25			4	21	5	29	14	44	24	27
Cholecystostomy plus choledochostomy	1	17											1	3	2	2
Cholecystectomy plus choledochostomy											1	6	6	19	7	8
Cholecystostomy only									1	5			1	3	1	1
Simple drainage									1	5	2	11	1	3	4	4
Pathological changes																
Subacute or chronic	2	17	1	17	1	25	1	17	2	11	4	23	5	16	9	10
Simple acute	1	17							3	16	2	12	4	12	12	13
Hydrops	1	17	4	66	2	50	1	50	10	51	5	29	12	38	37	41
Empyema	1	17	1	17			2	33	1	5			9	28	5	6
Gangrene	1	17							2	11	3	18	9	28	15	17
Perforation—abscess																
Perforation—generalized peritonitis	1	17			1	25			1	5	1	6			4	4
Stones present	6	100	5	83	4	100	6	100	16	89	16	94	30	94	83	92
Bacteriology																
Cultures taken	3		6		4		6		14		12		23		68	
Sterile	2	66	2	33	1	25	2	33	4	29	8	68	8	35	27	40
Escherichia coli			3	50	2	50	3	50	8	57	1	8	7	30	24	35
Streptococcus viridans					1	25					1	8	6	27	8	12
No known pathogen							1	17	1	7	1	8	1	4	4	6
Miscellaneous	1	33	1	17					1	7	1	8	1	4	5	7
Postoperative course																
Smooth	5	83	4	66	2	50	3	50	13	68	13	76	21	66	61	68
Fat	1	17					2	33	3	16	1	6	4	12	11	12
Stormy			2	33	2	50	1	17	3	16	3	18	7	22	18	20
Hospital days	21		22		35		27		26		27		31		28	
Mortality			1	17							1	6	3	9	5	5

By dividing the cases in the above manner we have two groups in which operation was performed during an acute phase of the disease—one relatively early, the other late, and a third group in which operation was performed in the interval after the acute manifestations had subsided.

The statistical data of each of these three main groups is combined in Table II for comparative study.

Let us now analyze each group more carefully in an effort to evaluate the results of early and delayed operation.

PATHOLOGICAL CHANGES FOUND

Taking up first the 41 cases in which the patients had immediate operation—how many of them had irreversible pathological changes at the time of operation? There is, of course, some difference of opinion as to what should be classified as “irreversible pathological changes.” Some authors

would include only cases of gangrene and perforation, while others would include the more virulent cases of empyema and simple acute cholecystitis. It is usually impossible to tell at the time of operation whether the inflammatory process is advancing or subsiding, but there would seem to be ample clinical evidence to the effect that the conditions of empyema, hydrops, and simple acute cholecystitis do subside spontaneously as far as clinical signs and symptoms are concerned. Perforation of the gall bladder with pericholecystic abscess is also known to undergo retrogressive changes in which the abscess becomes better walled off and more chronic in nature, with disappearance of clinical manifestations of disease. Thus, the term “irreversible pathology” does not necessarily mean that the disease process is a progressively fatal one. Including only the cases of gangrene and actual perforation, we have 11 cases, or 27 per cent of the group, in which a

strict pathological sense there were irreversible changes in the gall bladder wall. It is altogether possible that, had not immediate operation been resorted to, in a certain percentage of the 18 cases of empyema the condition would also have gone on to gangrene and perforation.

In the group of patients treated by delayed operation we have already seen that in 18, or 35 per cent of the group, the condition failed to subside clinically to the extent that conservative therapy was abandoned and emergency operation performed. In this group we find a high percentage of cases with so called irreversible pathological changes, namely, gangrene or perforation with abscess formation (41 per cent). It seems logical to assume, therefore, that the 27 per cent of cases in the first group would also have failed to respond to conservative therapy. In the face of these facts it would appear that about every third patient with acute cholecystitis who has been admitted to this clinic has presented such extensive pathological changes that a subsidence of the clinical symptoms by conservative measures was not possible. It is also of interest to note that of the 49 cases in the delayed group, only 9 patients, or 18 per cent, had subsided sufficiently by the time of operation to warrant a pathological diagnosis of subacute or chronic cholecystitis. This emphasizes the point stressed in the literature that it is often impossible to predict the extent of the pathological process from the clinical findings (18, 25, 28, 29, 30). Of the 32 cases in which a satisfactory subsidence of clinical signs was obtained, operation revealed 12 with empyemas and 6 with pericholecystic abscess.

It has been the dictum of the past to place perforation of the gall bladder among the rarities of surgical practice. However, in recent years, much has been written to the effect that this complication is much more common than was formerly believed (11, 15, 16, 19, 25, 30). Our experience corroborates this latter belief. Of the total 103 cases reviewed in this series there were 23 with perforations or 22 per cent of the series. In the greater portion of these there was sufficient walling off to form a pericholecystic abscess. However, there were 4 cases with perforation into the free peritoneal cavity and a generalized peritonitis (3.9 per cent). Thus, we see that the experience of this clinic with perforation of the gall bladder has been rather extensive, and about every fourth patient with acute cholecystitis admitted to the clinic has shown this advanced pathological change.

BACTERIOLOGY

Considerable work has been done on the bacteriological aspect of acute cholecystic disease and

a number of writers have emphasized the point that cultures of the pus from the empyema are often sterile (12, 20). Andrews, in a recent article, expresses doubt as to the existence of true empyema; he feels that in most cases of so called empyema the 'pus' is simply precipitated calcium or cholesterol.

In our series of cases the bacteriological findings correspond fairly well with those reported in the literature. Cultures were reported as sterile in about 40 per cent of the cases in which they were taken. *Escherichia coli* was the organism most commonly cultured, with *Streptococcus viridans* in second place. No cultures of *Bacillus typhosus* were obtained. We are inclined to agree with Andrews in his belief that in many instances the underlying lesion in acute cholecystic disease is vascular rather than infectious in nature and may be likened to a hemorrhagic infarct of the gall bladder wall. Impaction of a stone in the cystic duct is a very common finding in acute disease of the gall bladder and is undoubtedly a most important etiological agent.

Referring to Table II we see that in the patients operated upon early there were sterile cultures in 39 per cent, while in those cases in which the condition was allowed to subside cultures were sterile in 57 per cent, an increase of 18 per cent. It is interesting to speculate on the significance of this finding. Possibly the period of conservative treatment was instrumental in allowing the infection to burn itself out. It has been suggested that the bile may be a factor in reducing the virulence of the organisms. On the other hand, it may be argued that the factor responsible for subsidence in these cases was a higher percentage of sterile cultures from the beginning. In favor of this view is the fact that in the group in which the condition failed to subside on conservative treatment there was the lowest number of sterile cultures obtained (20 per cent).

The incidence of gall stones in this series of cases is striking, there being only 8 cases in the total number reviewed in which no stones were found. The incidence of stones was, therefore, about 92 per cent. Common duct stones were found in about 7 per cent of the series.

MORTALITY

The mortality figure for the entire group of cases was 5.6 per cent, a figure which corresponds favorably with other statistics in the literature (1, 16, 21, 23, 27, 30).

In the group having immediate surgery there were 3 deaths, giving a mortality of 7.3 per cent for the group.

TABLE II

Data	Group having early operation—		Group having delayed operation			
	Operated upon during an acute phase of the disease		Symptoms subsided Operated upon in interval		Symptoms failed to subside Operated upon during an acute phase	
Number of cases	41		32		17	
Average age	44		45		54	
Average temperature on admission	100.6		99.8		101	
Average leucocyte count on admission	17,000		15,600		15,100	
Average delay from admission to operation	11.5 hours		7.6 days		5.2 days	
	No	Per cent	No	Per cent	No	Per cent
Pathological changes						
Chronic or subacute cholecystitis			9	28		
Simple acute cholecystitis	0	22	1	3	2	12
Hydrops of gall bladder	3	7	4	13	1	6
Empyema of gall bladder	18	44	12	38	7	41
Gangrene not perforated	4	10			1	6
Perforation with abscess	3	7	6	18	6	35
Perforation with general peritonitis	4	10				
Stones present	37	90	30	94	16	94
Type of operative procedure						
Cholecystectomy	4	10	17	53	3	17
Cholecystostomy	32	78	10	31	10	59
Cholecystectomy choledochostomy	2	5	4	13	1	6
Cholecystostomy choledochostomy	2	5				
Choledochostomy alone					1	6
Simple drainage of an abscess	1	2	1	3	2	12
Bacteriology						
Cultures taken	32		21		15	
Sterile	12	35	12	57	3	20
Escherichia coli	13	41	2	20	7	47
Streptococcus viridans	3	9	3	15	2	13
No known pathogen	5	9			1	7
Miscellaneous	1	3			2	13
Mortality	3	7.3			2	12
Postoperative course						
Smooth		68		82		61
Notable complications		32		18		39
Average hospital days						
Total	27		28		32	
Postoperative	26		20		27	

One 74 year old man was moribund on admission but was operated upon and a gangrenous gall bladder with a generalized peritonitis was found. Cholecystostomy was carried out. Cultures grew *Escherichia coli* and *Streptococcus viridans*. His postoperative course was stormy and he died 7 days later of bronchopneumonia. Autopsy confirmed this diagnosis.

The second case was a woman 84 years old who had a simple acute cholecystitis complicated by common duct stones. The gall bladder was removed and the common duct was drained. She developed a blood stream infection with *Streptococcus viridans* and died on her thirtieth postoperative day. Autopsy showed a portal and mesenteric thrombophlebitis, suppurative pyelophlebitis, liver abscesses, and a subphrenic abscess.

The third case was a woman 71 years old, who had an empyema of the gall bladder for which a cholecystostomy was performed. Cultures grew *Escherichia coli*. She died shortly after operation, presumably from shock. No autopsy was obtained.

In the group in which the symptoms subsided and operation was performed in the interval, there were no deaths. In the group in which the symp-

toms failed to subside on conservative treatment, there were 2 deaths, or a mortality of 12 per cent.

One patient, woman, aged 75 years, was operated upon as an emergency 9 days after admission. An acute condition of the gall bladder was found, complicated by common duct stones and evidence of an acute cholangitis. Cholecystectomy and choledochostomy were performed and cultures of the bile grew *Escherichia coli*. After operation she developed a pulmonary edema with cough which brought about a wound separation and evisceration. Peritonitis followed and this was the cause of her death. No autopsy was obtained.

The other case was that of a 66 year old woman who was operated upon as an emergency after 3 days of conservative treatment. A perforated gall bladder with multiple pericholecystic abscesses was found and cholecystostomy was performed. Cultures grew *Escherichia coli* and *Streptococcus viridans*. She had a long and stormy course with a severe wound infection and a duodenal fistula. Eventually the evidence of a subphrenic abscess presented itself and this was drained transpleurally in two stages. She died shortly after the second stage, presumably of a pneumonia. No autopsy was obtained.

It is of interest to note that *Streptococcus viridans* was cultured in 3 of the 5 fatal cases. One also may observe that there is a tendency for the mortality figure to rise steadily as the pathological process increases in severity.

A glance at Table II shows no mortalities among the cases in which the symptoms were allowed to subside and the patients were operated upon in the interval. However, in the group in which symptoms failed to subside on conservative treatment, the mortality reached its highest peak (12 per cent). Although the series is small it would seem that this figure may be of significance.

If we analyze the mortality figures according to the type of operative procedure carried out, we find that 3 deaths followed cholecystostomy and 2 followed cholecystectomy plus choledochostomy. It must be remembered however that cholecystostomy was the operation of choice on the poorer risks and on the patients presenting the most marked pathological changes. The presence of common duct stones necessitating the opening of the common duct naturally increases the mortality in these elderly patients.

There was nothing unusual in the clinical history or physical examination of the fatal cases that labeled these cases as more serious than the average and the temperature reaction and leucocyte count were not out of proportion. However the average age of patients in the fatal groups was 71 years as compared with 46.4 years for the entire group. The average duration of symptoms before admission was 15 days or nearly twice as long as the average for the entire group. These two factors were probably important from the standpoint of mortality.

MORBIDITY

Referring again to Table II we see that the average number of postoperative days was slightly more for the patients operated upon during an acute phase of the disease. This is explained by the fact that in these cases cholecystostomy was done more often rather than cholecystectomy. The average number of postoperative days for patients receiving cholecystostomy was 26 days as compared with 17 days for those on whom a cholecystectomy was done. In other words the patient receiving a cholecystostomy must expect to remain in the hospital an average of 9 days longer than the patient who has the gall bladder removed. Furthermore, we find that wound infections and stormy postoperative courses appear more frequently in the cholecystostomy group. In evaluating the morbidity we should perhaps

realize again that cholecystostomy has been the procedure carried out on the more desperately ill patients, and this factor may easily account for some of the apparent differences.

LATE RESULTS OF CHOLECYSTOSTOMY

The late results of cholecystostomy vary markedly in different clinics (4, 8, 9, 17). Most writers report a high incidence of recurrence of symptoms, cholecystectomy eventually being necessary (6, 7, 24, 26). In this series of cases a follow-up report was obtained in 42 cases in which a cholecystostomy had been done for acute cholecystitis, the longest time interval since operation being about 7 years. Of these, in 80 per cent there was complete relief of symptoms immediately following the procedure, but in only 40 per cent was the relief permanent. The other 40 per cent had a recurrence of symptoms in from 1 month to 3 years following operation. There were 9 patients, or 20 per cent, who did not get even temporary relief. Seven patients or 17 per cent of the group followed came to re-operation. Two of these patients were re-operated upon while they were still in the hospital, cholecystectomy being carried out. A third patient returned in 1 month with a biliary fistula still present and a cholecystectomy was done at that time. A fourth returned for cholecystectomy in 3 months. The 3 other cholecystectomies were done 1 year, 2 years, and 4 years, respectively after the first operation. It is possible that, if 10 years hence the group were followed again the percentage of permanent relief from cholecystostomy would be even lower than 40 per cent (24).

The average duration of bile drainage following cholecystostomy was about 5 weeks, the extremes being 2 weeks and 3 months. This does not include 2 cases of apparently permanent biliary fistula which have been draining bile for 1 year and 3 years, respectively. The incidence of incisional hernia in the followed cases of cholecystostomy was 19 per cent. In the light of the figures given it would seem advisable to carry out cholecystectomy whenever at all feasible.

TREATMENT

As has been brought out, there were about an equal number of patients in this series who were operated upon immediately (41 cases) and treated conservatively (49 cases). The series should for this reason, be very well suited for a critical analysis of the merits of each form of treatment. It should be emphasized again that, in the strict sense of the word, very few of the patients were operated upon in the earliest stages of the disease.

(Table I) Since we seldom see very early cases in this clinic, our problem has been in respect to the treatment of the patients as we see them, several days having elapsed since the onset of their symptoms. In the patients operated upon within the first 24 hours after admission, the mortality was 7.3 per cent—a figure somewhat higher than the mortality for the entire group of cases. In the cases in which the symptoms were allowed to subside and the patients were operated upon during the interval there was no mortality. It would appear, therefore, that *if in each case the symptoms could be depended upon to subside, then the conservative form of therapy would be without question the most judicious*.

However, we are faced with the fact that of the 49 patients who were treated conservatively there were 17, or 35 per cent, who failed to subside and were by necessity subjected to operation in an acute stage of the disease. It is this group that carried the high mortality, the high morbidity, the greatest number of complications, and the greatest number of hospital days.

For this reason a careful analysis was made of this group in an effort to find some constant factor which might enable us to tell in advance in which cases it was possible the symptoms would subside on conservative management and in which they would not. A glance at the clinical symptoms is at once discouraging in this respect. *Pain, tenderness, and rigidity* are such constant findings that no help is offered along this line. *Jaundice* was seen more often in patients with perforation or gangrene than in any other single pathological condition. It was present in approximately half the patients who were later found to have a perforation. This is of very little diagnostic help, however, since it also occurs in simple acute cholecystitis, empyema, and of course in those cases in which a stone is present in the common duct. In our series it was seen eight times in empyema and nine times in simple acute cholecystitis. *Chills* similarly occurred with all types of the disease and were not always associated with common duct pathology. Chills associated with empyema occurred eight times and with simple acute cholecystitis and perforation of the gall bladder four times each. By far the majority of patients in whom a *palpable mass* was felt proved to have either an empyema or a hydrops of the gall bladder. However, a mass, or at least a questionable mass, was also felt in 7 cases with perforations and pericholecystic abscesses, and in 6 cases of simple acute cholecystitis. A study of the *temperature reactions* produced by the various types of cholecystic disease was also marked by disappointment,

the group of cases showing the most marked pathological changes had only very slightly higher temperatures than the average of the entire series. There were 21 patients having fever over 102 degrees, 8 of these had empyema, 4 had simple acute cholecystitis, 4 had perforations, 3 had gangrene, and 2 had subacute cholecystitis. It soon becomes obvious that we cannot estimate the extent of the disease by the febrile reaction it produces.

Finally we turn to the *leucocyte count* for help. This laboratory test has been suggested by several authors as the most reliable indication of the severity of the inflammatory process (27, 30). There were 33 cases in this series having leucocyte counts over 15,000. Of these, approximately 50 per cent were in patients with empyemas. The other 50 per cent were about equally divided among the other groups. Although the highest counts were seen in cases of empyema there were enough low ones to bring the average of the entire empyema group down to 15,000. As a matter of fact, in 44 per cent of the empyema cases the leucocyte counts were below 15,000. The average leucocyte count of the cases in which symptoms failed to subside on conservative therapy was 15,100, the average leucocyte count of the group of fatal cases was only 16,600.

Thus we are forced to admit, as so many have done in the literature, that we are often quite helpless in predicting the extent of the pathological process until the abdomen has been opened at the time of operation. In the cases in which symptoms failed to subside on conservative management, we find a high percentage of stones impacted in the cystic duct (89 per cent) and a higher percentage of perforations (35 per cent). There was also a higher percentage of positive cultures obtained in this group. The patients in this group were 4 to 5 years older than the average of the entire series, and the delay in coming to the hospital was 1 to 3 days more—factors which may be of some significance. However, there was nothing in the symptomatology or physical signs on admission that would lead one to suspect a more active or progressive type of infection. We must, therefore, face the facts and state once more that we cannot with any degree of certainty tell in advance in which cases symptoms will subside on conservative management and in which they will not. An increase in the amount of pain, tenderness, or rigidity, a rising temperature, or a rising leucocyte count should certainly be indications to discontinue conservative therapy in favor of operation.

Indeed, it would appear that there are entirely too many factors at work in the course of acute

cholecystic disease to afford much hope for the standardization of its treatment. Until we have learned the reason why in some cases the disease progresses and in others subsides, the best form of therapy would seem to be one of individualization. For those who are experts in the surgical treatment of the biliary tract, the hazards of operation during the stage of acute inflammation are, of course, not so great. However, the practice of early operation in an indiscriminant fashion by the general run of surgeons would probably bring about an increase in the mortality throughout the country. In each case there is an optimum time for operation and the determination of which must be based on a study of the individual problem.

A discussion of acute cholecystic disease is not complete without due emphasis in regard to the prophylactic treatment. Practically all writers on this subject bring out the fact that a high percentage of cases give histories of gall bladder disease in the past (15). In our series of cases, gall stones were present in 92 per cent. There were 13 patients in the entire group in whom the attack bringing them to the hospital was the first manifestation of cholecystic disease. The remaining 87 per cent gave a history suggesting biliary tract disease and about half of them had experienced definite biliary colic.

SUMMARY

1 The treatment of acute cholecystic disease has produced a great deal of controversy in the literature and general agreement is still lacking. There can be observed in recent publications a definite tendency to resort to surgery earlier in preference to the policy of conservative therapy, reserving operation until the interval.

2 Another series of surgically treated cases of acute cholecystitis is added to the literature for the statistical value which it may afford.

3 An analysis of the series in respect to the duration of symptoms before operation was of little value in establishing an optimum time for surgical intervention.

4 The fact that, of the 90 typical cases in this series, 41 were treated by immediate surgery and 49 were treated conservatively makes the series of special value in analyzing the relative merits of these two policies of treatment.

5 Each group has been analyzed from all aspects of the disease. From the standpoint of both mortality and morbidity, the best results were obtained in cases in which symptoms were allowed to subside on conservative management and the patients were operated upon in the interval. However, of the total group treated by conservative

measures, there were 32 per cent in which symptoms failed to subside and the patients were of necessity subjected to emergency surgery in an acute phase of the disease. These patients showed an even higher mortality and a greater morbidity than the patients who were operated upon as emergencies on admission.

6 No criterion was found by which it was possible to tell in advance with any certainty in which cases symptoms would subside and in which they would not.

7 The incidence of gangrene and perforation of the gall bladder was much higher than the teaching of the past has indicated in nearly a fourth of the cases in this series this complication is shown.

8 The results of cholecystostomy are discussed, based on a follow up of 42 patients so treated.

9 The problem of acute cholecystic disease is probably too complicated to be handled by any certain stereotyped policy of treatment. It would appear that this is a disease par excellence to be treated by individualizing each case as to the optimum time for operation.

Note—I am greatly indebted to the late Dr. Howard L. Beve my recent chief and counsellor for his many helpful criticisms and his mature judgment in the analysis of the data obtained in this study.

BIBLIOGRAPHY

- 1 ALEXANDER, EVERT G. Acute perforation or rupture of the gall bladder. *Ann. Surg.* 1927 85 465-469.
- 2 ANDREWS, EDWARD. Pathologic changes of diseased gall bladder: a new classification. *Arch. Surg.* 1935 31 76-93.
- 3 BEHRND, MOSES. Acute inflammation of the gall bladder: conservative operative treatment. *Ann. Surg.*, 1934, 99 925-940.
- 4 BLALOCK, ALFRED A. Clinical study of biliary tract disease. *J. Am. M. Ass.* 1924, 83 2057-2060.
- 5 BRUGGEMAN, HENRY OTTO. The treatment of acute cholecystitis. *Ann. Surg.* 1918, 87 423-427.
- 6 CASTELL, RICHARD B. End results of surgery of the biliary tract: a study of 634 cases treated at the Laker Clinic. *Ann. Surg.*, 1929, 89 930-941.
- 7 CAYE, HENRY W. Dangers incident to cholecystostomy. *Ann. Surg.* 1916, 84 377-386.
- 8 CONNELL, F. GREGORY. Femote results of biliary surgery. *Ann. Surg.*, 1928, 8 837-843.
- 9 DARNER, H. LAURAN, and CULLEN, THOMAS S. The end results in nearly three hundred cases in which the gall bladder was drained—not removed. *Surg., Gynec. & Obst.*, 1923, 37 579-593.
- 10 Discussion following presentation of papers at the American Surgical Association. *Ann. Surg.*, 1933 98 777-799.
- 11 ELLISON, E. L., and EBB, WILLIAM. Mortality in surgery of the biliary tract. A comparison of two 3 year periods. *Ann. Surg.*, 1935, 101 460-463.
- 12 ELLISON, E. L., and McLAUGHLIN, CHARLES W. Perforation of the gall bladder. *Ann. Surg.*, 1934, 99 914-924.

- 13 FIFIELD, LIONEL R. Perforation and rupture of the gall bladder *Brit M J*, 19 6, 2 635-636
- 14 GRAHAM, HENRY F, and WATERS, HENRY S. Important factors in the treatment of cholecystitis *Ann Surg*, 1934, 99 893-899
- 15 HAYES, J M. Acute conditions of the gall bladder *Minnesota Med*, 1934, 17 319-323
- 16 HEUER, G J. Factors leading to death in operations upon biliary tract *Ann Surg*, 1934, 99 881-892
- 17 JOHNSON, THOMAS B, and PEARRE, A A. A clinical study of the results of 470 operations on the gall bladder *South M J*, 1926, 19 889-892
- 18 JUDN, E. STARR, and PHILLIPS, J. ROBERTS. Acute cholecystic disease *Ann Surg*, 1933, 98 771-776
- 19 Idem. Perforation of the gall bladder in acute cholecystitis *Ann Surg*, 1933, 98 339-361
- 20 LIPSCHULTZ, BENJAMIN. Acute cholecystitis *Ann Surg*, 1935, 101 902-911
- 21 MENTZER, STANLEY H. The acute gall bladder manifesting few signs or symptoms *Surg, Gynec & Obst*, 1932, 53 709-716
- 22 MILLER, RICHARD H. Acute cholecystitis *Ann Surg*, 1930, 92 644-648
- 23 PRATT, GERALD H. Cholecystectomy and cholecystostomy in acute suppurative and gangrenous cholecystitis *Am J Surg*, 1933, 22 46-52
- 24 SAINT, JAMES H. The late results of operation on the biliary tract in 359 cases, with cholecystographic studies in 18 *Brit J Surg*, 1935, Oct, 299-326
- 25 SMITH, MORRIS K. Treatment of acute cholecystitis *Ann Surg*, 1933, 98 766-770
- 26 SPURLING, ROY G, and WHITAKER, LESTER R. End results of cholecystostomy as shown by the cholecystogram *Surg, Gynec & Obst*, 1927, 44 463-467
- 27 STEINKE, CARL R. Acute gall bladder disease *Am J Surg*, 1935, 27 135-138
- 28 STONE, HARVEY B, and OWINGS, JAMES C. The acute gall bladder as a surgical emergency *Ann Surg*, 1933, 98 760-765
- 29 TOLROFF, ARTHUR S W. Acute cholecystitis. A study of 75 proven cases with subsiding or subsided clinical manifestations at the time of operation *Ann Surg*, 1934, 99 900-913
- 30 ZIMMERER, MAX M. The surgical treatment of acute cholecystitis *Ann Surg*, 1932, 96 406-412

A SIMPLE AND EFFECTIVE METHOD FOR THE CLOSURE OF BILIARY FISTULAS

W WAYNE BABCOCK, M D, F A C S, Philadelphia, Pennsylvania

PERSISTENT fistulous openings following drainage of the gall bladder usually discharge clear mucus, if a mucocele or hydrops of the gall bladder is present, or mucopurulent material, if due to a gall stone impacted in the neck of the gall bladder or cystic duct, or to a carcinoma. If the mucocele is a result of stenosis of the outlet, the gall bladder should be removed or the lining mucosa completely destroyed. A stone impacted in the neck of the gall bladder often may be removed without hospitalization of the patient. The fistulous tract is first enlarged by daily insertion of rubber tubes of increasing caliber, or by firm gauze packing until a channel of sufficient size is formed to the point of obstruction. The calculus may then be detected with a probe or seen through a Kelly cystoscope or a urethroscope, dislodged by scoop or forceps, and removed. At times it is necessary to incise cautiously, or partially to destroy dense scar tissue overlying the stone. The latter may be accomplished by the application of small cotton swabs lightly moistened with a 10 per cent solution of chloride of zinc. If this powerful erosive is used, little should be applied and attempts to remove the stone delayed for 24 to 48 hours, during which time a firm dry gauze packing is left in place. To reduce the size of the exposed impacted stone, cotton swabs wet with ether may repeatedly be applied until sufficient cholesterolin has been dissolved from the stone to enable its fragmentation, dislodgement, and extraction. With all obstruction removed the fistulous tract usually closes permanently within a few days. It is to be remembered that an acute or subacute purulent cholecystitis with gall stones is not uncommon in an unsuspected cancerous gall bladder. Twice after the calculi had been removed and the mucopurulent fistula closed, have we seen a cancer later develop in the abdominal scar.

Persistent partial leakage of the bile after cholecystectomy or the withdrawal of a drain from the cystic ducts usually indicates some type of obstruction in the ducts. In such a case we fit a rubber tube snugly in the fistulous channel and connect it with a Wagensteen or Pratt aspirator.

Usually within 24 or 48 hours the flow of bile ceases when the tube is removed and the opening is permitted to close.

Fistulas following cholecystectomy or operation upon the biliary ducts from which all bile is discharged are much more troublesome and serious. From the constant loss of liquid, electrolytes and the impaired intestinal absorption, the patient tends to develop an increasing cachexia with impaired ability to withstand a serious operation. Usually the fistula has resulted from an accidental division to the common duct during a cholecystectomy or the common duct may have been drained but a more distal obstruction to the flow of bile has not been removed. Occasionally the fistula follows a cholecystostomy and is due to an obstruction of the common duct.

Irrespective of cause and at times despite the retention of average weight, the patient may be a poor subject for any prolonged intra abdominal operation. To attempt to anastomose a divided duct or to unite the proximal end of an obstructed duct with the duodenum or stomach is a hazardous procedure. It is simpler to mobilize the abdominal fistula and to turn it into the adjacent duodenum or stomach, but the liberation of the fistulous tract is not always easy and the tract

Fig. 1 Line of excision of old scar after delineating fistulous tract by the injection of ethereal solution of methylene blue.

Fig. 2 The scar and subcutaneous fascia have been removed thus exposing the sheath of the right rectus muscle with the fistulous opening. Parallel incisions have been made through the muscle on either side of the fistulous tract. Through the medial incision the duodenum has been withdrawn and sutured to the anterior sheath of the rectus. After completion of this suture line the margins of incision in the duodenum are to be sutured about the fistulous opening.

Fig. 3 The withdrawn duodenum is further sutured over the anterior sheath of the rectus by completing the outer row of encircling suture.

Fig. 4 The top sketch illustrates the withdrawn duodenum (or stomach) united to the split rectus muscle over the fistulous channel. In the middle sketch the segment of rectus muscle is so rotated that the attached portion of duodenum (or stomach) has been returned to the peritoneal cavity. In the bottom sketch the margins of the anterior and posterior sheaths of the unused part of the rectus muscle have been united by suture.

Fig. 5 Closure of the anterior rectus sheath over the rotated and depressed segment of rectus.

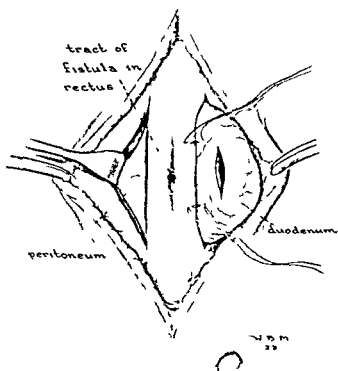


Fig 2

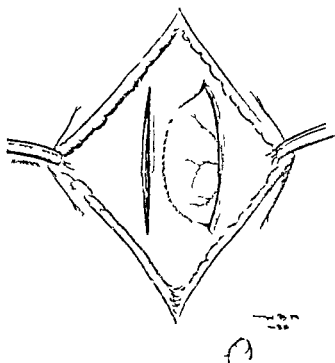


Fig 3

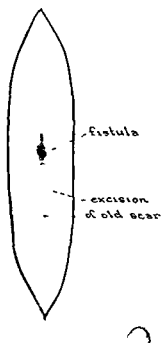


Fig 1

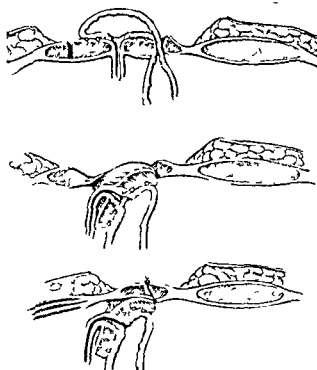


Fig 4

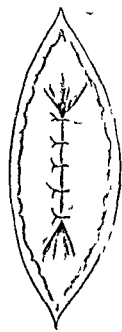


Fig 5

(Legends on opposite page)



Fig 1 Before and after reduction. Note that wide separation of the two bones is maintained by the fixation pins and that the free ends of these pins extend beyond the skin surface

With the fragments held rigidly in complete end-on apposition, a hole the size of the steel pin to be used was drilled obliquely across the line of fracture in the plane intersecting both bones. The pin was then inserted through the drill hole and forced across the interosseous space until it contacted the opposite bone and had forced the two slightly apart. The pins are of sufficient length so as to protrude through the wound and beyond the skin surface where they can be grasped easily with a forceps and removed very simply when it is no longer necessary to retain fixation.

Objectionable is the possibility that the pins may injure large vessels, the ulnar, the deep branch of the radial or even the median nerve as they are forced across the interosseous space. To help prevent such an accident pins with smooth blunt ends were used in a case just recently treated.



Fig 2 Before and after reduction was obtained and after the fixation pins had been removed. It is to be noted that preservation of a broad interosseous space has been accomplished.

Figure 1 shows roentgenograms of a boy of 7 years who fell 2 feet from the top of a fence July 14, 1936, sustaining simple complete fractures of both bones of the left forearm with overriding of fragments. Three days after injury and after three unsuccessful attempts at reduction by manipulation, the patient was referred to the University Hospital where a fourth unsuccessful attempt was made.

Five days later the fracture sites of the radius and ulna were exposed through separate incisions, the fractures reduced and fixed with pins, both of which were extended across the interosseous space. Eighteen days later there was roentgenographic evidence of union, both pins were removed without anesthesia during course of a dressing.

In Figure 2 are shown roentgenograms of a girl aged 14 years who fell down a stairway July 10, 1936, and suffered simple fractures of both bones of the left forearm with displacement and overriding of fragments of the radius. The patient was referred to the University Hospital 5 days after injury. The arm had been unsuccessfully manipulated three times, twice before and once after admission. At operation, the fragments of the radius were exposed, reduced and fixed with two pins, one extending across the interosseous space. Roentgenograms 18 days later demonstrated the presence of sufficient callus to permit removal of the pins.

RESECTION OF THE RIGHT HALF OF THE COLON

JOHN deJ. PEMBERTON, M.D., F.A.C.S. and FORIN D. WHITTAKER, M.D.
Rochester, Minnesota

WITHIN recent years there have been many advances in the surgical treatment of diseases of the colon. Of the noteworthy factors which have contributed to its progress, the following may be mentioned: (1) earlier recognition and treatment of colonic diseases made possible because of educational campaigns and also because of improved diagnostic methods; (2) pre-operative measures directed to rehabilitation of the patient and to decompression and cleansing of the colon; (3) intraperitoneal vaccination to fortify the patient's resistance to the spread of infection; (4) the employment of balanced anesthesia to insure relaxation without noxious effects of deep narcosis; (5) improvement in operative technique; and (6) the more general utilization of the principle of the multiple stage operation.

In spite of these advances, however, there are many pressing problems still confronting the surgeon and these must be solved before surgery of the colon can be considered on a plane equal to that of general abdominal surgery. In support of this it is necessary only to call attention to the high mortality following surgery of the right half of the colon as reported from various hospitals: 15 to 30 per cent (1, 2, 3, 4, 5). When it is realized that among the most frequent causes of failure in colonic surgery are spread of infection (peritonitis) and intestinal obstruction, and since these are not always necessarily unavoidable complications, it is clear that there is at least a hopeful approach to the problem.

The success or value of certain surgical procedures, however, cannot be judged by the mortality alone. The question of what constitutes and what does not constitute an operable lesion influences the mortality. A low mortality will result when operation is performed in only highly selected cases, but certain patients will thus be denied surgical intervention which, if undertaken, would give them a good chance for recovery and restoration of health. A balance must therefore be maintained between what can safely be done on the one hand and the desire to help the patient toward recovery on the other.

From the Section on Surgery, The Mayo Clinic and the Division of Surgery, The Mayo Foundation. Read before the meeting of the Texas Surgical Society, Dallas, October 5 and 6, 1936.
Dr. Whittaker now resides at his home, Ill. 16901.

The surgical problems presented by lesions of the right half of the colon differ in certain important respects from those of lesions in other segments of the large bowel. These differences are concerned chiefly with the character of the lesion and the type of operative procedure indicated. The tendency of lesions common to the right portion of the colon is to perforate rather than to obstruct, whereas lesions in other segments of the colon tend to obstruct early in their course. The operative procedure suitable for lesions of the right half of the colon is commonly limited to intraperitoneal resection of this part of the colon in whole or in part, together with re-establishment of the continuity of the intestinal tract by means of ileocolostomy. Lesions involving other segments on the other hand frequently can be removed by one of several types of procedure, such as by extraperitoneal resection by an exteriorization operation or by segmental resection. For reasons of safety, the operation of resection of lesions involving the colon other than on the right side is today usually carried out in multiple stages, whereas for lesions on the right side, perhaps because of the absence of obstruction, the need for the graded procedure is not usually recognized.

The employment of the two stage procedure for resection of the right half of the colon, the application of certain underlying principles in deciding the type of anastomosis to be used, and the use of the present technique, which will be described, have combined to give a lower mortality and at the same time probably have increased the limits of operability. The basis of this study has been a series of 46 consecutive cases in which resection of the right half of the colon was performed by one of us (Pemberton) during the past 6 years. In 8 cases a single stage procedure was employed; in 38 cases a two stage procedure was used employing the principles and technique to be described. In addition there were 5 cases in which ileocolostomy was performed.

METHOD

The type of anastomosis to be made at the time of ileocolostomy, or first stage, is determined by application of the following principles. In most of the uncomplicated cases lateral ileocolos-

tomy is preferable because of its safety. The danger of interference with the blood supply to the small bowel is obviated and a safety valve is afforded, for part of the fecal current will pass beyond the anastomosis through the normal channel. An end to side ileocolostomy is preferable under certain conditions. In the presence of a fecal fistula in the region of the cecum, ascending colon, or distal portion of ileum, this procedure is necessary in order completely to divert the fecal stream. Subsidence of the inflammatory reaction in the region of the fistula is thereby permitted, which will facilitate resection of the right half of the colon during the second stage of the operation. If the patient is thin, an end-to-side anastomosis may also be used when the cecal growth is intussuscepted and is causing pain (a side to-side anastomosis will not relieve the pain). Likewise, in cases of inflammatory lesions of the terminal portion of the ileum, an end to side anastomosis often is preferred since it permits a greater subsidence of the inflammatory process (Figs 1, 2, 3, 4, and 5).

The patient who is to undergo resection of the right half of the colon usually enters the hospital 2 days before operation for pre operative preparation. Repeated irrigations are given by rectum on the day of admittance and on the day preceding operation. Likewise, a mild saline laxative is administered. During the afternoon and evening before operation paregonic is administered. The bowel is aspirated the morning of operation. A non-residue diet is permitted. Blood transfusions are given if needed to relieve marked anemia. In addition, it is the usual custom to introduce, intraperitoneally, 48 hours before operation, 1 cubic centimeter of a vaccine composed of killed *Bacillus coli* and *Streptococcus hæmolyticus* in 10 cubic centimeters of physiologic saline solution.

The first stage of the operation, as has been said, is ileocolostomy. A liberal incision is made through the inner third of the right rectus muscle and this extends about an equal distance above and below the umbilicus. The abdomen is explored and the lesion is examined to determine its nature, operability, and the type of ileocolostomy indicated. A loop of terminal ileum is selected about 6 or 8 inches (15 to 20 centimeters) from the ileocecal valve and approximated to the transverse colon. If side to side anastomosis is indicated, the anastomosis is made over rubber-covered clamps, two rows of chromic catgut are used and the anastomosis is reinforced with adjacent omentum. The anastomosis usually is made antiperistaltic. If an end-to-side anastomosis is indicated, the ileum is divided between

clamps about 6 or 8 inches from the ileocecal valve. The distal end is then closed and replaced in the abdomen. The proximal end is approximated to the transverse colon, preferably by the use of a Rankin three bladed clamp, which permits of a more nearly aseptic union. Again two rows of chromic catgut are used and the line of suture is protected as before. The omentum is then carefully replaced over the small bowel in its normal position and the abdomen is closed in layers without drainage.

The patient then remains in the hospital approximately 2 weeks. The time interval between stages is determined entirely by the condition of the patient, but usually he has begun to gain weight and is stronger, and the wound is sufficiently healed so that the second stage can be performed in about 3 weeks' time.

Pre operative preparation for the second stage is similar to that for the first except that intraperitoneal vaccination is omitted, for it is felt that the ileocolostomy has brought about sufficient vaccination of the abdomen.

The location of the incision for the second stage, or resection, is of vital importance to the success of the operation. The incision is made lateral to the scar of the incision for ileocolostomy, through the outer third of the right rectus muscle. When the abdomen is opened, the omentum will be found adherent to the anterior abdominal wall at the site of the old incision, thus walling off the small bowel from the field of operation (Fig 2). Approach to the right half of the colon is thus made through a compartment separate from the general peritoneal cavity. A small square gauze pack is placed at the lower angle of the wound to complete isolation of the field of operation.

Resection of the involved segment of bowel starts with separation of the lateral peritoneal reflexion to the right half of the colon. The blood supply to that portion of the terminal ileum and right colon to be resected is then clamped, divided, and ligated. After the cecum, ascending colon, and terminal 2 to 3 inches (5 to 7 centimeters) of the ileum have been freed from all mesenteric attachments, a decision must then be reached regarding disposal of that portion of the ileum distal to the previously made side-to-side ileocolonic anastomosis which is to be preserved. Unless some contra-indication exists, the terminal portion of ileum and proximal portion of transverse colon are approximated by means of a three-bladed clamp, the intervening segment of bowel involved by the lesion being removed by dividing the ileum and colon flush with the clamp, and then by means of an inverting stitch.

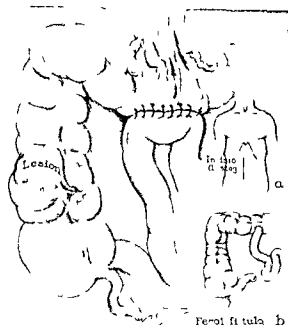


Fig 1 First stage in resection of right half of colon showing the usual side to side ileocolostomy a incision b end to side ileocolostomy (preferable in certain cases)

anastomosing the end of the ileum to the end of the colon. Thus a second ileocolonic anastomosis is made which affords an escape of that portion of the fecal current which passes beyond the

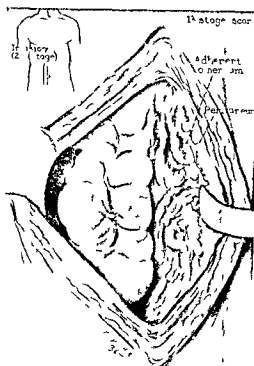


Fig 2 Second stage in resection of right half of colon showing omentum adherent to scar of first stage incision

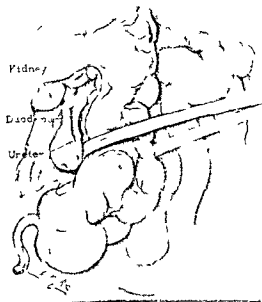


Fig 3 Second stage in resection of right half of colon separation of lateral peritoneal reflection to the right half of colon showing retroperitoneal structures to be avoided

lateral anastomosis. In most instances this is the easiest and simplest method of disposing of the stumps of the ileum and colon (Fig 4).

Conditions may exist however, which make it unsafe to attempt this end-to-end union. For example, if the colon is greatly dilated at the site of the proposed end to end anastomosis, there will be a great disproportion in the size of the colon and ileum. Likewise, when the patient is obese and the mesentery is laden with fat, the added technical difficulties may be too great to establish an accurate and safe union. In the event that it seems unwise to make this union, the end of the colon and the end of the ileum are each inverted separately. In such a disposal of the end of the ileum it is important that the ileum be cut across close to the site of the anastomosis ($\frac{3}{4}$ inch). If a longer segment of ileum is preserved distal to the side to side anastomosis, part of the fecal current will pass beyond the anastomosis into this segment, and then, because of peristalsis in this segment, there is danger that the end of the bowel will be blown out, or, if it holds, the peristaltic movements of the bowel will produce pains like those produced by any intestinal obstruction (Fig 5). If the first stage procedure consisted of end to side ileocolostomy the distal loop

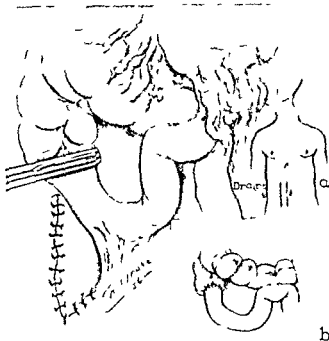


Fig 4 Second stage in resection of right half of colon, showing completion of resection and beginning of end to end anastomosis of ileum to colon a, positions of incisions and stab drain, b, completion of end to end anastomosis

of ileum is removed with the cecum and ascending colon, and the proximal end of the colon is inverted. The amount of colon left proximal to the ileocolonic anastomosis is not of so much importance, for peristalsis runs away from and not to the remaining segment, as in the segment of distal ileum. The defect in the posterior peritoneum is closed, and the mesentery of the small and large bowel is approximated, if necessary. Through a stab wound in the right loin two Penrose drains are inserted, which insure dependent drainage.

It is customary to complete the second stage of the operation without seeing any loops of small bowel except that part to be resected, since, as has been indicated, resection is done in a separate compartment of the abdomen which can be said to be almost extraperitoneal in relation to the general abdominal cavity. Any drainage that may occur comes from the stab wound in the loin, the incision heals primarily in almost every case. Again, the stay in the hospital is about 2 weeks.

RESULTS

There were 2 deaths in the group of 38 cases in which the two stage procedure was employed, giving a mortality of 5.2 per cent (Table I). These 2 patients who died had extensive perforating cancers of the right half of the colon, the inoperability of which was determined only after an attempt had been made to remove them. An

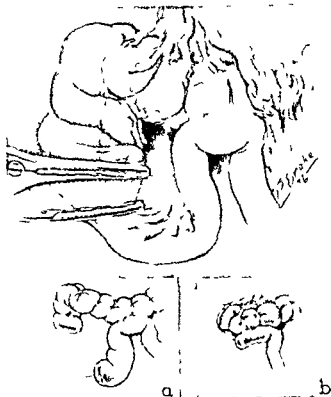


Fig 5 Second stage in resection of right half of colon, showing marked disproportion between end of ileum and end of colon, preventing accurate end to end anastomosis a, incorrect closure of ileum, giving rise to a distended loop with possible perforation, b, correct closure of distal ileum close to site of ileocolostomy

abstract of these 2 cases is appended. Ileocolostomy, as a first stage procedure, was performed in 5 additional cases in which resection did not follow. There were 2 cases of borderline operability in which resection was impossible, in 1 case the wound was closed on exploration at the second stage because of the extent and fixation of the malignant growth, the other patient was not subjected to the second stage of the operation because of persistent marked debility. In the third case, that of an inflammatory lesion of the cecum, the patient showed improvement following ileocolostomy sufficient to warrant delay in further surgery. There were 2 deaths, one the result of pneumonia and the other of the unusual complication of thrombosis of the lower vena cava with clear ascites and right hydrothorax. These 4 deaths in the series of 43 cases in which two stage resection was performed or contemplated give a total mortality for both stages of 9.3 per cent.

The 2 deaths in the series of 43 cases in which ileocolostomy was performed and the 2 deaths in 38 of these cases in which second stage resection was carried out give comparable mortalities and illustrate the fact that the risk of resection of the

TABLE I—RESECTION OF RIGHT HALF OF COLON (TWO STAGE OPERATION)

Diagnosis	Total	Males	Females	Age range years	Operation				Operative findings							Course following			
					Ileocolostomy		Resection		Ileal	Mucosa	Perforated	Omentum	Intussusception	Marked inflammatory reaction	No lesions in ileum	Ileocolostomy		Resection	
					Side to-side	End to-side	End to-end	Closed ends								Uneventful	Continued pain	Uneventful	Pulmonary symptoms
Carcinoma of cecum	11	6	5	35-75	11		10*	2	6	2	4	4	2	1	5	9	2	11	
Carcinoma of cecum and ascending colon	3	3		57-69	3		3			3		2				3		3	
Carcinoma of ascending colon	9	9		31-64	9		4	5	1	6	3	4			4†	7	1	5	2
Carcinoma of ascending colon (cecostomy)	1	1		48		1		1			1					1		1	
Carcinoma of hepatic flexure	2	2		41-67	2		1	1	1		2	1				2		1	1
Carcinoma of hepatic flexure with duodenocolic fistula	1	1		52	1			1	1		1					1		1	
Tuberculosis of cecum and ascending colon	2	1	1	26-35	1	1	1	1		1						2		2	
Granuloma of cecum and terminal ileum	3	2	1	32-54	1	2	1	2	1			2		2		3		2	1
Regional ileitis	2	2		22-31		2		2		2		1				2		2	
Inflammatory granuloma with fecal fistula	3	2	1	20-30	2	1	2	1	2					3		3		3	
Fibroma of cecum	1		1	40	1		1			1						1		1	
Total	18	15	3		11	7	23	15	12	14		11	3	6	9	34	3	30	4

Resection of portion of wall of bladder
 *Metastasis to liver—patient requested palliative operation
 †Partial duodenectomy with duodenoplasty

{Fatal massive collapse and pneumonia
 {Duodenal fistula—fatal pneumonia
 {Resection of portion of greater curvature of stomach

right half of the colon is no greater than that of the preliminary ileocolostomy. The clinical course following resection is distinctly quieter than that following ileocolostomy.

In this same period primary one stage resection of the right half of the colon was performed in 8 cases (Table II). In cases with distant metastasis in which the procedure was for palliation, in cases with marked bleeding from the malignant lesion, and in cases of a few thin patients with freely movable growths it seemed advisable not to subject the patients to a second operation and one stage resection accordingly was performed. Obviously, then, this group is not comparable to that in which two stage resection was carried out. There was 1 death, or a mortality of 12.5 per cent. The small number of cases, of course, gives little significance to the figure for mortality. The death in this group was secondary to peritonitis, no death in the group of cases in which two stage resection was performed resulted from peritonitis. In addition, the postoperative course in the one group was not comparable to that in the other. The postoperative course following one stage resection was distinctly

more stormy, more critical and more prolonged than that following either the first or second stage of the two stage procedure (Figs. 6 and 7).

ADVANTAGES

The operation as carried out in two stages has certain advantages. The development of the separate compartment by adherence of omentum to the scar of the first incision and the subsequent placing of the second incision to enter into this compartment offer certain safeguards not available otherwise. In the first place the handling of the small bowel, with the resultant trauma and possible spread of infection is practically obviated, as the small bowel does not enter into the field of operation. If the end-to-end anastomosis or the blind, closed ends of ileum or colon should leak from any cause or if there should be gross soiling during mobilization and resection of the involved bowel, the resultant infection will be confined to the compartment and can be controlled readily by the dependent drainage through the loop.

The clinical course following resection which is the more extensive operation, usually is attended

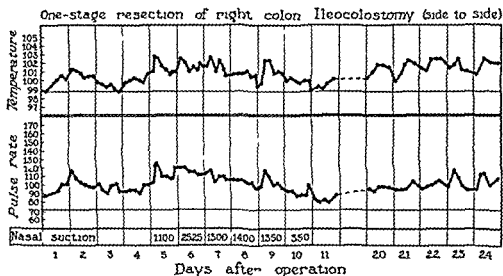


Fig 6 Pulse rate and temperature following one stage resection of right half of colon Ileocolostomy (side to side)

with less reaction than that following ileocolostomy. Figure 8 is a chart of the 38 cases in which patients were subjected to two stage resection and shows a composite of the daily mean temperature curves following each stage of the operation. The smoother clinical course that follows the second stage is best explained by the fact that manipulative trauma to the small bowel is avoided and any contamination associated with resection is localized in the separate compartment outside of the general peritoneal cavity, and perhaps also by the immunity acquired by vaccination of the peritoneum induced by the previous operation.

In cases of fecal fistula the advantages of the two stage operation are obvious. An end-to-side

anastomosis diverts the fecal current from the fistula, permits marked subsidence of the associated inflammatory reaction about that portion of the bowel to be resected, and reduces to a minimum the discharge from the fistula. Furthermore, if resection of the bowel is necessary later, it is done in the aforementioned compartment separate from the general peritoneal cavity, thereby limiting to this compartment any spread of infection. The same is in general true in cases of an inflammatory lesion of the terminal portion of ileum and cecum, for example regional ileitis, typhlitis, and inflammatory granuloma of the cecum. A preliminary end-to-side anastomosis permits subsidence of the inflammation to a varying degree by diversion of the fecal current

TABLE II—RESECTION OF RIGHT HALF OF COLON (ONE STAGE OPERATION)

Diagnosis	Total patients	Males	Females	Age range years	Operation			Operative findings						Postoperative course				
					Ileocolostomy (end to side)	Ileocolostomy (side to side)	Enterostomy	Fixed	Movable	Perforated	Obstructing	Intussuscepted	Marked inflammatory reaction	Lymph nodes involved	Uneventful	Ileus	Temporary obstruction	Fecal drainage
Carcinoma of cecum	3	3		29-64	2	1	3		3			2		1*	2	1†		
Carcinoma of ascending colon	2	2		54-49	1	1	1		2					1‡		1‡	1	1
Tuberculosis of cecum	1	1		33		1	1			1					1			
Tuberculosis of cecum with cecal fistula	1		1	19	1		1	1					1		1			
Tuberculous ileitis	1		1	20		1	1†			1	1						1	
Total	8	6	2		4	4	7	1	5	2	1	1	1	2	4	2	2	1

*Peritoneal implants palliative operation

†Distended passed no gas died

‡Metastasis to liver palliative operation

§Required nasal suction for 7 days passed some gas recovered

¶ symptoms of obstruction emergency enterostomy recovered

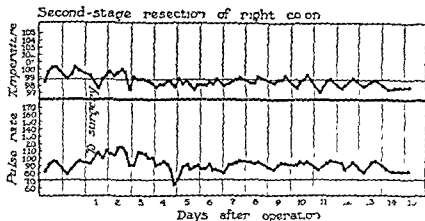


Fig 7 Pulse rate and temperature following second stage resection of right half of colon

The general condition of the patient improves following diversion of the fecal current, and thus if further operation is necessary the risk is reduced.

The value of this two stage procedure in which the second stage or resection of the colon is performed in a compartment separate from the general peritoneal cavity is further exemplified by those cases in which gross contamination occurred. Fecal drainage from the stab wound developed in 3 cases in this series following resection. Drainage was tolerated nicely, however, and in no case did ileus develop from infection secondary to leakage from the anastomosis. The clinical course was quiet. In 2 cases the fistula healed spontaneously within 2 or 3 weeks, respectively. In one fatal case there was drainage of bile, duodenal content and seropurulent matter from the stab drain, yet peristaltic activity was not embarrassed. The bile and purulent

drainage subsided and at necropsy no evidence of generalized abdominal infection was found. Associated partial gastric resection was carried out in 1 case, and partial duodenectomy in 2 cases, convalescence was uneventful except in the fatal case, which will be described later.

The value of end-to-side ileocolostomy with complete diversion of the fecal stream, which permits subsidence of the inflammatory reaction in the region of fecal fistula and thus facilitates the subsequent resection is demonstrated by the following representative case.

A man aged 20 years had an inflammatory lesion of the cecum and terminal portion of ileum complicated by a fecal fistula. A side-to-side ileocolostomy was thought to be the safest procedure. The mass was markedly fixed. Two months later resection was advised but at operation the mass was still fixed and the risk of resection was high. The distal portion of ileum therefore was divided and the anastomosis was converted into an end-to-side ileocolostomy to permit diversion of the fecal stream. There was marked subsidence of drainage from the fistula. At the time of resection some time later the growth was quite free and resection was done with minimal risk. Occasionally in cases of an inflammatory lesion of the ileocecal region in which the pathological process is not too far advanced, end-to-side ileocolostomy permits of such improvement both clinically and roentgenologically that resection may prove unnecessary.

ABSTRACT OF TWO CASES IN WHICH PATIENTS DIED

The two cases in which the patients died following the second stage of the two stage operation are presented in some detail. As stated before it becomes difficult at times to maintain a balance between the desire to give each patient his chance of cure and what must be considered an inoperable condition. In both these cases the operability must be considered questionable at best.

CASE 1: A man aged 6 years in poor health was subjected to side-to-side ileocolostomy for carcinoma of the

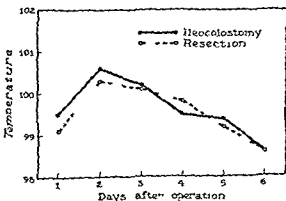


Fig 8 Composite of daily mean temperature curves in 38 cases following each stage of the operation.

hepatic flexure of the colon on October 3, 1935. The growth was the size of a double fist (about 10 centimeters in diameter) and was fixed. Convalescence was slow and the patient was permitted to return home in the hope that he might gain more strength. After 2 months he returned very little improved and weakened by diarrhea. The risk of operation was graded 3 on a basis of 4. The abdomen was explored and the right half of the colon resected on December 2, 1935. The growth had perforated necessitating its separation from the liver, posterior abdominal wall and retroperitoneal portion of the duodenum. The patient's immediate postoperative course was satisfactory until the third day, when definite collapse of the right lower lung developed. He passed some gas, but the abdomen was slightly distended. Death came on the sixth postoperative day and was thought to be due to pulmonary complications.

CASE 2. This second case was very interesting and again demonstrated to us the value of the two stage procedure. The patient, a man, aged 52 years, entered the clinic complaining of loss of weight, anemia, and diarrhea. He was found to have carcinoma of the hepatic flexure, this had perforated and a fistula with the second portion of the duodenum had resulted. Ileocolostomy, side to side, was performed on June 11, 1936. The fistula was noted, and a fixed mass, the size of a fist, was found in the colon. The lesion was thought probably to be inoperable. The patient, however, made a splendid recovery from the ileocolostomy, and gained weight, and it was thought best to attempt resection, which was carried out July 9, 1936. Exposure of the mass revealed its extensiveness and fixity, and once it was exposed it was necessary to continue with the resection. The growth was separated from the liver, leaving much raw surface. The fistula was excised, and an opening 6 by 4 by 3 centimeters in the duodenum (which was left) was closed. The growth was perforated during resection and some gross soiling took place. The immediate postoperative course was quite gratifying. The patient passed gas and liquid stools on the third day and continued to do so. Bile and seropurulent drainage from the stab drain in the loin persisted for a few days. A duodenal fistula developed on the sixth postoperative day, but this was controlled with suction. Bronchopneumonia, graded 3+, developed, and death occurred on the twenty second postoperative day. Necropsy revealed the presence of the fistula, but the abdominal cavity was free of infection. No carcinoma was found.

Here, then, are 2 cases in which there were extensive growths and in which the patient was subjected to extensive surgery with obvious

soiling, grossly in 1 case, yet death was due to pulmonary complications. Had it been necessary to handle the small bowel, with exposure of the general peritoneal cavity, death no doubt would have ensued promptly from peritonitis.

SUMMARY AND CONCLUSIONS

The employment of the two stage operation for resection of the right half of the colon and the application of the principles and technique described have combined to give a lower mortality in surgery of the right half of the colon and at the same time have undoubtedly increased the limits of operability.

In a consecutive series of 38 cases second stage resections of the right half of the colon were performed, with 2 deaths, or a mortality of 5.2 per cent. Ileocolostomy, as a first stage procedure, was performed in 43 cases, with 2 deaths. These 4 deaths in the series of 43 cases studied give a total mortality for both stages of 9.3 per cent. There were no deaths secondary to peritonitis.

Resection of the right half of the colon as the second stage is the more formidable procedure, but it has been performed at no greater risk and with less reaction than the preliminary stage of ileocolostomy.

REFERENCES

- GHITZESCU, C. I., GHIMPEZIANU, M. V., and ROBACKI, I. Ueber die Resektion des Caecums und des Colon ascendens (die rechte Hemikolektomie). *Figene einzeitige operative Technik Zentralbl. f. Chir.*, 1935, 62: 2603-2620.
- HARVEY, S. C. The one stage operation for resection of the cecum and proximal colon. *New England J. M.*, 1934, 211: 1039-1044.
- MILLER, R. T., JR. Cancer of the colon. *Ann. Surg.*, 1923, 78: 209-225.
- OUGHTERSON, A. W., and SHELTON, MERRIWELL, T. End results in the treatment of carcinoma of the colon. *Yale J. Biol. Med.*, 1934, 6: 433-456.
- TURNER, G. G. Cancer of the colon. *Lancet*, 1929, 1: 1017-1023.

THE TREATMENT OF THROMBOPHLEBITIS

With Acetyl-Beta-Methyl Choline Chloride Iontophoresis

HUGH L. MURPHY, M.D. Brooklyn, New York

THROMBOPHLEBITIS constitutes one of the most stubborn and disabling conditions affecting the lower extremities. Despite the many forms of treatment, including long periods of rest in bed with elevation of the legs and the use of supportive bandages which have been recommended during the past 50 years, in a large percentage of these cases healing fails to occur. In many instances there continues a low grade, smoldering condition which is easily activated by traumatism or by prolonged standing. In others the condition becomes chronic with a superimposed lymphedema of the entire extremity. In this report a new method of treatment of thrombophlebitis which appears to be more satisfactory than any hitherto suggested is described.

ETIOLOGY

Thrombophlebitis is an inflammation of the vein wall with a secondary thrombosis due to changes in the endothelium. According to Karsner the vein may be involved in the inflammatory process either directly or through the medium of lymphatics, i.e. there may be a lymphangitis involving the veins. There are the suppurative and non suppurative types of thrombophlebitis. Slowing of the blood flow is a predisposing factor in the causation of this condition. Thrombophlebitis is quite common following a prolonged stay in bed from any cause. It is also frequently found after operation, and especially after pelvic operations. Febrile diseases, such as pneumonia, typhoid fever, and especially in influenza are frequently complicated by thrombophlebitis. Anemia and increased coagulability of the blood predispose to the development of this entity. Trauma in the presence of a quiescent phlebitis is very often the exciting cause of a recurrence of the acute stage. Syphilis, gout, and tuberculosis have been found to be associated frequently.

PATHOLOGY

Because of the anatomical relationship of the veins of the left lower extremity, this member when the condition is unilateral has been most frequently involved. In the majority of cases however, both legs are involved. The involvement

From the Vascular Clinic of St. Mary's Hospital.

may vary in degree from the presence of a small nodular thrombus to that of the most severe type of thrombophlebitis, e.g. phlegmasia alba dolens, in which the iliac or femoral vein is blocked. Also, in some cases the onset may be sudden, acute, with the typical fever, chills, and excruciating localized pain while in others the symptoms are mild, but there are noted the persistent tiredness, soreness, and occasional ankle edema after prolonged standing.

According to Lencze pain, edema and functional impotency in phlebitis come from a disturbance of the innervation of the vascular wall, "an excitation of a sensible nerve, which plays a more important part than the mechanical obstruction of the blood stream." Thus the spastic element of phlebitis plays an important rôle in the pathogenesis of the attending functional trouble.

Aside from the pain associated with thrombophlebitis there are other changes which are dependent on venous and lymphatic obstruction, i.e. edema of the subcutaneous tissues of varying degrees from a transient ankle edema to a persistent brawny edema of the pseudo-elephantiasis type, from the ankle to the groin. In the chronic form this edema has been found to persist over a period of 20 years in some cases.

TREATMENT

Logically the clearing up of a thrombophlebitis with venous and lymphatic obstruction should be dependent on an increase in the local circulation, the elimination of the local edema and the relief of pain, without increasing the danger of the formation of emboli. In the acute stages of thrombophlebitis the practice of anything but the most conservative and classical methods would be contrary to all known principles. The patient should be given absolute rest and the limb elevated to avoid the danger of pieces of soft thrombus being dislodged and thrown into the general circulation. When the thrombus is firm however as we find in the long standing or afebrile cases, treatment may be instituted toward the relief of pain due to venospasm and toward the improvement of circulatory imbalance by aiding the local circulation in the elimination of the local edema. Many of the previous forms of treatment, such as rest

and elevation of limb, the use of elastic bandages, rubber stockings, or "Unna's boot," ligation of veins, have been used as controls in this series in an attempt to promote this physiological state but without satisfactory results.

A group of workers (1) at the Post Graduate Hospital has recently reported successful results in the use of acetyl beta methyl choline chloride¹ by the method of iontophoresis in the treatment of chronic varicose ulcers (4), by which the local circulation was stimulated very effectively. Thrombophlebitis is a closely associated condition and is very often found to precede the formation of chronic varicose ulcers. In the vascular clinic of St. Mary's Hospital we have collected a series of 33 cases followed over a period of 1 year in which this method of treatment alone was used. These patients had had the thrombophlebitis for from 1 week to 20 years without relief from any previously used treatment. The average age of the patients in the series was 52.6 years. The average number of treatments given was 15, with a minimum of 4 in Case 6, and a maximum of 63 in Case 13. This latter patient had a severe, long standing chronic phlebitis with marked lymphedema and also a large varicose ulcer of the leg (10 by 8 centimeters). The average period of treatment was 6.7 weeks with treatments given two to three times per week.

In this report we present the results of the treatment of the first 33 consecutive cases of thrombophlebitis that have come under our care since we began this form of treatment. No selection of cases was undertaken. We would stress the following conditions of our experiments:

1 Our patients had been through a period of control ranging from 1 week to 20 years during which time all recognized forms of treatment for this condition had been tried on one or more of them without success.

2 During our period of treatment only 4 patients were hospitalized or put to bed. These came to us with such severe pain due to the thrombophlebitis that they were unable to work, but not one of these was required to stay more than 1 week in the hospital. They were all urged to go about their usual work.

3 No other form of treatment was used with the possible exception of the comforting support of an ace elastic bandage for the first week or two, after which it was discarded.

4 No patients with acute thrombophlebitis with fever, chill, etc., is included in the series as we believe it would not be wise in these to attempt any treatment other than rest and elevation.

However, after the febrile stage had subsided we instituted this form of treatment with no untoward results and a shortening of the period of disability.

5 In the evaluation of the degree of disability caused by the thrombophlebitis in each case, a relative scale of from one plus (1+) to four plus (4+) was used, one plus indicating but slight subjective discomfort in getting about at their usual daily routine, and four plus indicating a complete disability. Some of these latter patients had to be hospitalized, the others were able to come to the clinic on crutches or in wheel chair from their auto to the treatment room, especially during the early course of the treatments. The other degrees are estimated proportionately.

6 The results obtained are classed as improved or not improved depending upon, (1) the objective signs such as disappearance of tenderness along the involved veins, loss of edema, and healing of ulcers, and (2) subjective symptoms of loss of pain, of tiredness, and of heaviness of the legs after their usual hours of routine work. The relative grade of improvement is scaled proportionately in the results obtained.

MECHANISM OF HEALING, PRECAUTIONS

The mechanism by which this healing is accomplished is not clear. Three explanations may be advanced. The results may be due to any one or a combination of the three. First, the production of an increased local circulation may promote a more rapid removal of the waste products and increase in local nutrition thus producing regeneration of the tissues, second, the marked local diaphoresis, which may continue for from 4 to 8 hours after the treatment, may reduce the edema resulting from the hydrostatic pressure and, by relieving the tissues of this overload of fluid, may permit healing, or, third, the relief of the spastic element of the phlebitis may lessen the disturbance of the innervation of the vascular wall which plays a part in the mechanical obstruction of the blood stream. In these cases, injection of veins is a definite contra-indication until long after the active phase is passed, and, even then, there is danger of recurrence and embolism. No active form of treatment such as massage, heat or diathermy, may safely be given to favor healing. It is therefore of benefit that some safe method of therapy may be used not only for the relief of pain, but also for the re-establishment of a balanced circulation in these affected limbs.

When one considers the lack of success that has accompanied the treatment of chronic thrombophlebitis heretofore and the encouraging results

¹Drug supplied through kindness of Merck & Co.

TABLE I--THE TREATMENT OF PHLEBITIS WITH ACETYL-BETA-METHYL CHOLINE CHLORIDE IONTOPHORESIS

Patient	A # Sta	Type phlebitis	Duration	Disability	Etiology	Duration of treatment	No treatments	Result	
1 W B	68 M	Chronic bilateral and lymphedema	20 yrs	++	Appendectomy	7 mos	16	Improvement	++
2 A K	28 F	Acute bilateral deep femoral	3 yrs	++++	Thyroidotomy	2 wks	9	Little improvement	—
3 C T	51 F	Subacute bilateral	10 mos	+++	Cholecystectomy	8 mos	22	Improvement	+++
4 G H	40 M	Chronic left leg and lymphedema	16 yrs	++	Influenza	2 mos	16	No edema	++
5 M T	53 F	Subacute bilateral	2 yrs	++++	Grippe	6 wks	8	Improvement	++++
6 A C	56 F	Subacute bilateral	3 mos	+++	Colitis auricular fibrillation	1 wk	4	Improvement	++
7 A M	54 F	Subacute bilateral	1 mo	+++	Chronic sinusitis	9 days	5	Improvement	+++
8 J T	50 M	Chronic bilateral lymphedema and ulcer	2 yrs	+++	Pleurisy	3 mos	20	No edema	+++
9 M G	63 F	Subacute bilateral	2 mos	+++	Cholecystitis	6 wks	17	Improvement	+++
10 E H	57 F	Subacute bilateral	21 mos	++	Colitis	3 mos	12	Improvement	++
11 A D	49 F	Subacute bilateral	15 y	+++	Influenza	2 mos	11	Improvement	+++
12 P B	30 M	Chronic bilateral and multiple ulcer	12 yrs	++++	Pulmonary tuberculosis	17 days	17	Ulcers heal	++++
13 W T	48 M	Chronic left leg lymphedema and ulcer	5 yrs	++++	Traumatic varicose ulcer	5 mos	63	No edema	+++
14 A P	49 M	Chronic bilateral and lymphedema	1 yr	++	Sinusitis	2 mos	26	No edema	++
15 M F	54 F	Acute bilateral	7 yrs	++++	Trauma	1 mo	16	Improvement	++++
16 J L	55 F	Subacute bilateral	1 yr	++	Cholecystitis	2 mos	10	Improvement	++
17 A B	63 F	Subacute in left leg	3 mos	+++	Influenza	1 wk	5	No improvement	—
18 D S	38 F	Subacute in left leg	1 mo	++	Trauma	1 wk	6	Improvement	++
19 C B	38 M	Chronic left leg lymphedema and ulcer	20 yrs	++++	Typhoid fever	3 mos	50	No edema	+++
20 G D	50 M	Subacute in left leg	1 mo	++	Strain	1 mo	12	Improvement	++
21 J O C	61 F	Acute in right leg	2 wks	+++	Overexertion	1 mo	11	Improvement	+++
22 S Z	70 F	Chronic left leg varicose ulcers	1 wk	++	Standing	1 mo	10	Ulcer healing	++
23 A S	4 F	Subacute bilateral	2 yrs	++	Standing	22 days	8	Improvement	++
24 B K	72 F	Subacute bilateral	8 yrs	++	Colitis	1 wk	6	Improvement	++
25 E G	41 F	Subacute bilateral	1 yr	+++	Hysterectomy	6 wks	12	Improvement	+++
26 E F	52 F	Acute bilateral	2 yrs	++++	Hypertrophic arthritis	2 wks	9	Improvement	+++
27 T B	36 F	Subacute bilateral	2 mos	++	Infection	2 wks	16	Improvement	++
28 A L	68 F	Chronic bilateral	9 mos	++	Hypertrophic arthritis	3 wks	16	Improvement	++
29 B G	71 M	Subacute in left leg	6 mo	++	Arterial occlusion	1 mo	15	Improvement	++
30 E S	45 F	Acute right leg varicose ulcers	4 mos	++++	Trauma	10 days	5	Improvement	+++
31 M K	49 F	Subacute bilateral	2 yrs	++	Influenza	1 mo	9	Improvement	++
32 M S	57 F	Subacute bilateral	3 yrs	+++	Cholecystitis	1 wk	6	Improvement	+++
33 G H	48 F	Subacute bilateral	1 mo	++	Hysterectomy	1 wk	6	Improvement	++

shown in practically all of the cases herein reported, this method warrants further study and clinical use

TECHNIQUE (4)

A standard 0.5 per cent solution of acetyl beta-methyl choline chloride is used. Reinforced asbestos paper saturated with the 0.5 per cent solution of the drug is wrapped around the foot and leg as high as the thigh. A malleable metal plate is placed over the wet asbestos paper and is connected to the positive pole of a galvanic machine. A large, regular, moist electrode is used as a dispersive electrode. This is placed under the back and is connected with the negative pole. The current is turned on slowly and increased to 20 or 30 milliamperes. At the end of the treatment, the current is slowly reduced and turned off. Treatment is given in some cases daily, but generally, for from 20 to 30 minutes, two to three times weekly.

General reactions A moderately severe reaction resulting from this iontophoresis treatment might be characterized by (1) a marked flush extending over the face, chest, and upper part of the abdomen, (2) increase in the pulse rate, (3) a deeper, slower respiratory cycle, (4) a marked drop in the blood pressure (which has been so profound on several occasions that it was necessary to terminate the experiment with atropine), (5) marked salivation (in one instance as much as 140 cubic centimeters of saliva was collected in 20 minutes), (6) marked lacrimation, (7) profuse diaphoresis, (8) increased intestinal peristalsis with abdominal griping and occasional immediate defecation, (9) occasional substernal pressure, (10) diuresis, in certain individuals, to a varying degree, (11) slight cyanosis of the tips of the extremities, with a drop in the surface temperature, which usually rises above the original level in from 1 to 6 hours. If desired, immediate cessation of effects may be produced by the injection of atropine, one one hundredth grain (0.00065 gram) subcutaneously.

These systemic reactions constitute an exact duplicate of the reactions following the subcutaneous or intravenous administration of the same drug but are more certain, more prolonged, and more easily controlled. They are rarely noted with iontophoresis except in the mild form.

Local reactions In addition, there is a characteristic local reaction, directly under the site of the application of the drug. This consists of (1) a feeling of prickling followed by warmth during the treatment, (2) the appearance of goose flesh immediately after the removal of the asbestos

paper, (3) a local blush of the skin, (4) sweating of the skin, which may continue from 6 to 8 hours, (5) an elevation in surface temperature, during treatment, followed by a drop during profuse sweating (with accompanying evaporation) and a rise above the former level in from $\frac{1}{2}$ to 5 hours.

Neither the general nor local effects noted can be produced with the use of saline iontophoresis or by the galvanic current alone. Likewise they cannot be produced by merely soaking the area in a solution or by using an ointment containing up to 25 per cent of the drug. Acetyl beta-methyl choline chloride solution plus the use of the galvanic current must therefore, be responsible for the effects.

Individuals vary in reactions, as in the use of most drugs. Some individuals who scarcely react to the first treatment show an increasing reaction to subsequent treatments.

RESULTS

Acetyl beta methyl choline chloride iontophoresis has been used in the treatment of 33 cases of thrombophlebitis. The age, type, duration, and degree of disability, duration and number of treatments, and the results are given in Table I. Thirty-one patients were definitely improved and were able to get about with ease and without the aid of any supporting bandages whatever. Of 488 treatments given, not one untoward reaction was noticed. Cases with lymphedema cleared up remarkably in a comparatively short time after years of progressive discomfort. Associated varicose ulcers healed readily. This confirmed the reports from the vascular clinic of the New York Post Graduate Hospital (4).

The 2 cases in this series with unsatisfactory results had received too few treatments to give the method a fair trial. Their case histories follow.

CASE 2. A K, a young woman of 28 years, had a severe acute bilateral thrombophlebitis of 3 years' duration, involving the deep femoral and iliac veins. This condition followed a thyroidectomy and resulted in complete disability due to pain. She also had a severe secondary anemia with a hemoglobin of 50 per cent and a hypothyroidism with a basal metabolic rate of -20. She came to the clinic for four treatments over a period of 2 weeks and then stopped because of the great effort necessary for her to attend. She was advised to enter the hospital but did not follow this advice.

CASE 17. A B, a woman of 63, had a subacute thrombophlebitis involving her left leg of 3 months' duration and with a disability graded as 3+. An attack of influenza preceded the onset of her disability. She was given 5 treatments in 1 week with little or no improvement. She left this vicinity due to some family situation, with her treatments incomplete. She expects to return at a later date for further treatments.

REFERENCES

- 1 KOVACS JOSEPH The iontophoresis of acetyl beta methyl choline chloride in the treatment of chronic arthritis and peripheral vascular disease Preliminary report Am J M Sc. 1934 183 32
- 2 KOVACS, JOSEPH, SAYLOR LESLIE and WRIGHT I S The pharmacological and therapeutic effects of

certain choline compounds Am Heart J, 1936, 11 53

- 3 LERICHE Hull Soc d obst. et de gynéc de Par, 1936 25 215

- 4 SAYLOR LESLIE KOVACS JOSEPH DURYEE A W and WRIGHT I S The treatment of chronic varicose ulcer by acetyl beta methyl choline chloride iontophoresis J Am M Ass, 1936 107 114-117

A MODIFIED SIEVE GRAFT

A Full Thickness Skin Graft for Covering Large Defects

LESTER R. DRAGSTEDT, M D Ph D, and HARWELL WILSON, M D, Chicago, Illinois

IN 1930, Beverly Douglas described in this Journal¹ a method for transplanting relatively large full thickness skin grafts which he first devised and used in 1928. He called it a 'sieve graft method because the graft is uniformly perforated with small round openings'. The advantage of the method to which he drew attention was that it provided for adequate drainage, prevented the accumulation of serum or exudate between the graft and underlying bed and so afforded a better opportunity of overcoming wound infection. The method of preparing the graft was so devised as to leave behind numerous small islands of skin from which regeneration could occur making it unnecessary to treat further the donor site. We used the method of Douglas a number of times and became impressed with its practical value. It retained the advantages of the Wolfe-Krause full thickness graft in preventing contracture and providing a new skin surface resistant to minor injuries while also affording a higher incidence of take especially in the presence of a moderate infection.

The method which we wish to describe in this report retains the advantages of the perforated full thickness graft of Douglas while it greatly facilitates healing of the donor site. In addition the graft is easier to prepare, requires no special instruments, and the operation is much less time consuming. The wound to be grafted is prepared in the usual manner. An oval shaped transplant as illustrated in Figure 1, a, is then prepared, care being used to secure the full thickness of skin with none of the subcutaneous fat. The long

axis of the graft should be about one third longer than the long axis of the wound to be covered. The lax skin of the abdominal wall furnishes an excellent donor site, and since the wound is elliptical it can be readily closed, usually without undercutting. As soon as secured the graft is placed, dermal side down, on a smooth towel moistened with physiological salt solution, and then with a small sharp scalpel numerous short incisions are made as illustrated in Figure 1, b. These incisions should be overlapping and when completed permit the graft to be stretched into any desired shape. In practice we have found that the original graft need not be more than one third to one half the width of the defect to be covered. The transplant is sutured into place and pressed into firm contact with the underlying bed. Vaseline gauze is then placed over the graft and covered with flat gauze and sea sponges in the manner advocated by Blair. The sponges are removed in 7 days and the graft is inspected. Stitches are removed and the compression dress-

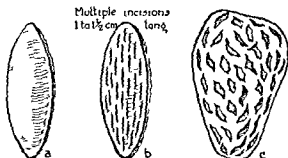


Fig 1 a, Oval shaped transplant b numerous overlapping incisions c graft stretched to shape of area to be covered

From the Department of Surgery of the University of Chicago

¹Douglas Beverly Surg Gynec & Obst., 19 4 30 1018



Fig 2 Appearance of wounds in Case 1 in 7 days and in 25 days after operation



Fig 3 Condition of wound in Case 2 in 9 days and in 30 days after operation

ing is reapplied for another week, when ordinary dressings are used. The donor site has invariably healed within a week or 10 days and this fact constitutes one of the chief advantages of the method.

The following abstracts of case histories illustrate our experience to date.

CASE 1: Unit No 92936 S. M., male, aged 27 months. Eighteen hours before admission the right arm was caught in a clothes wringer. On examination a hematoma was found on the volar aspect of the arm extending from the axilla to just below the elbow and the entire extremity was markedly swollen. The skin was cleansed with water and alcohol and sterile dressings were applied. Twenty-four

hours later an area of necrosis 5 centimeters in diameter appeared in the cubital fossa. This area extended gradually to the axilla. Operation was done 9 days after the injury. The necrotic tissue, skin and subcutaneous tissue was excised leaving a large wound on the volar aspect of the arm extending from the cubital fossa to the axilla. A full thickness graft, elliptical in shape, was taken from the anterior abdominal surface, treated as described, and sutured into the defect. The abdominal wound was closed and healed in 8 days. All of the transplant took except for a small area of separation at the upper angle. This was resutured and the wound was entirely healed in 18 days. The photographs which are shown in Figure 2 give the appearance of the wounds in 7 days and in 25 days after operation.



Fig 4 Condition of transplant and donor site 10 days after operation

CASE 2 Unit No 141835 C M female aged 53 years. Following a radical mastectomy for carcinoma of the breast a defect (11 by 5 centimeters) remained in the incision which could not be closed. A full thickness transplant was taken from the neighboring lax skin of the abdomen and was sutured into the wound. Figure 3 left shows the condition of the wounds at the end of 9 days, and right at the end of 30 days.

CASE 3 Unit No 120640 L L female aged 53 years. A melanoma was excised from the dorsum of the left foot leaving a defect extending from just above the ankle to the mid portion of the foot and measuring 12 by 7 centimeters. A full thickness graft from the abdominal wall was sutured

into place and although the wound became infected the entire transplant survived. The photographs in Figure 4 show the condition of the transplant and the donor site 10 days after operation. The transplant was completely healed in 30 days.

SUMMARY

The description of a simple, practical method for using full thickness skin grafts to cover relatively large defects is given. The method described utilizes the sieve graft principle of Beverly Douglas.

MUSCLE-SPLITTING EXTRAPERITONEAL LUMBAR GANGLIONECTOMY

FELIX L. PEARL, M D, San Francisco, California

SINCE the pioneer work of Royle in 1924, the extraperitoneal approach to the lumbar sympathetic ganglia has gradually gained favor over the transabdominal route. It has the advantages of lower mortality and smoother postoperative course which outweigh the disadvantage that only one side can be done at a time. In the transabdominal approach it is sometimes very difficult to remove the second right lumbar ganglion. All the serious complications which are apt to follow intra-abdominal surgery may follow the transabdominal route.

In the Royle approach (Fig 1) the external oblique and internal oblique muscles are separated from their attachments to the iliac crest by cutting directly across their fibers close to their insertions. This tends to increase tissue reaction and to favor the accumulation of serum. Attempts to approximate the retracted ends cause strangulation and additional trauma to the divided muscles. These factors predispose to delayed healing, infection, and the possibility of incisional hernia.

Since 1934 the author has been concerned with improving extraperitoneal lumbar ganglionectomy by the development of a completely muscle-splitting approach. In all, three incisions have been developed on fresh cadavers and subjected to clinical trial. Two early methods, to be mentioned later, have been discarded in favor of the following operation.

Anesthesia Subarachnoid block is preferable because it gives complete muscle relaxation.

Step 1 The patient is placed supine with the side of operation slightly elevated 5 or 10 degrees by one small pillow placed under the homolateral hip (Fig 1). Fine black silk is used throughout. A straight incision (Fig 3) about 18 centimeters long is then made through the skin and subcutaneous tissues in the direction of the fibers of the external oblique muscle, 4 centimeters mesad to the anterior superior iliac spine, and extending from the lower costal margin to midway between the anterior superior iliac spine and the pubic spine. The fascia of the external oblique muscle is exposed, but no attempt is made to undercut the subcutaneous tissues.

From the Clinic of Sympathetic and Vascular Surgery, Mount Zion Hospital, San Francisco Surgical Service of Dr. Harold Brunn.

Step 2 The external oblique muscle and fascia are then split over the full extent of the incision in the direction of their fibers. The muscle is dissected carefully from the underlying internal oblique muscle, being careful to undercut only as much as is necessary to expose the line of split in the internal oblique. Retractors are placed to expose the internal oblique at the desired site.

Step 3 (Fig 4) The internal oblique muscle is then split in the direction of its fibers at such a point that the line of split points to the body of the second lumbar vertebra. The point is important in allowing exposure of the medial lumbocostal arch because of the drag on the retractors produced by the upper flap of the external oblique. The flaps are freed from the underlying closely attached transversalis muscle and fascia, and retractors are placed so as to expose about

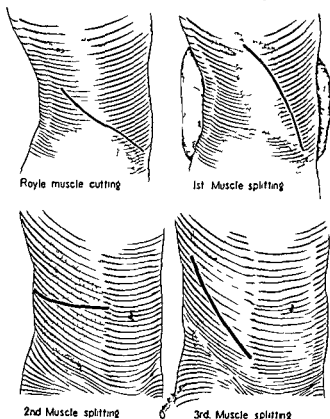


Fig 1 Incisions used in the Royle muscle cutting and the various muscle splitting approaches. Note the wide area of undercutting of skin and subcutaneous tissue in the first and second approaches. No undercutting is necessary in the final (third) muscle splitting operation.

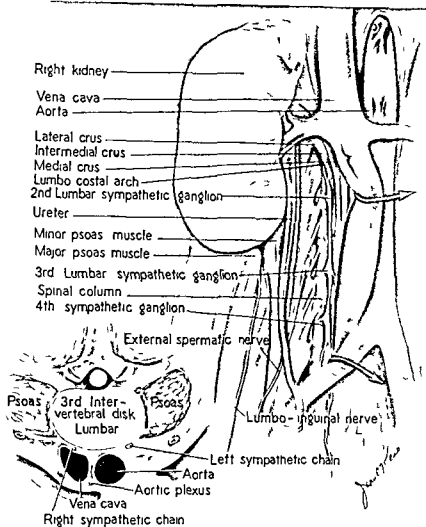


Fig. 2 Important anatomical relations involved in lumbar ganglionectomy. Note that the second ganglion is the highest ganglion usually seen. The first ganglion is hidden under the musculature of the lumbocostal arch. Also note that the rami of the second ganglion are directed cephalad whereas those of the third and fourth ganglia are directed caudad or transversely. The inset shows the left sympathetic chain just lateral to the aorta whereas the right sympathetic chain lies directly under the vena cava.

15 centimeters of the latter at the level of the body of the third lumbar vertebra and in the direction of its fibers.

Step 4 (Fig. 5) The transversalis muscle and its fascial continuation are split in the direction of their fibers for about 15 centimeters, the mesial limit being at the lateral border of the rectus sheath. The retroperitoneal fat is thus exposed. In splitting this layer, care must be taken not to injure the peritoneum. It is best to begin the split posteriorly and to extend it carefully anteriorly.

The peritoneum is the more easily torn as it nears the rectus sheath.

Step 5 (Fig. 6) The retroperitoneal fat containing the ureter is then freed from the underlying tissue with the hand. Care must be taken that the dissection is carried anterior to the fascia covering the quadratus lumborum and the psoas muscles. It is easy to carry the dissection deeply in the wrong plane if this is not borne in mind. The retroperitoneal fat is dissected mesad to the bodies of the vertebrae, cephalad to the crura of

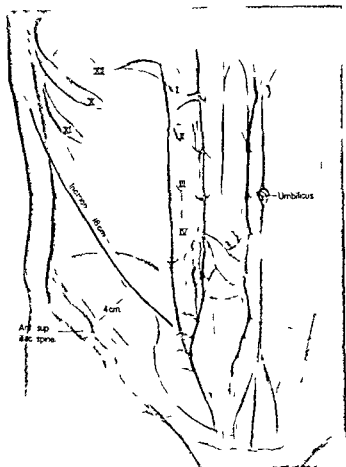


Fig 3

Fig 3 Skin incision and anatomical relations

Fig 4 The external oblique muscle and aponeurosis have been split for the full length of the skin incision with out undercutting the subcutaneous tissue. The internal oblique muscle has been exposed and split in the direction of its fibers in a line pointing to the top of the second lumbar vertebra and from the iliac crest to the rectus sheath. The underlying transversalis muscle is thus exposed.

Fig 5 The external oblique and internal oblique muscles have been retracted so as to expose the transversalis muscle. The latter has been split along its fibers for a distance of about 15 centimeters, the separation extending anteriorly to the lateral margin of the rectus sheath. The retroperitoneal fat is thus exposed.

the diaphragm, and caudad to the brim of the pelvis. Retractors are useless until this is completed. A special retractor devised by Royle or a similar wide retractor is then inserted, and the parietal peritoneum with the abdominal contents is retracted mesad. Another retractor may be used to draw the psoas muscle laterad, although this may not be necessary. A thin fascia covers the psoas muscle, great vessels, and sympathetic chain. This is opened and dissected free (Fig 6).

On the left side the sympathetic chain is found on the bodies of the vertebrae, in the sulcus between the psoas muscle and the aorta. By moving the retractors caudad or cephalad the sympathetic chain can be exposed from the medial lumbocostal

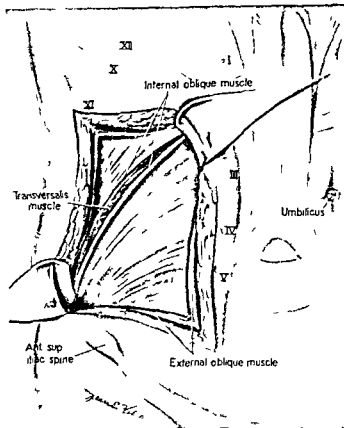


Fig 4

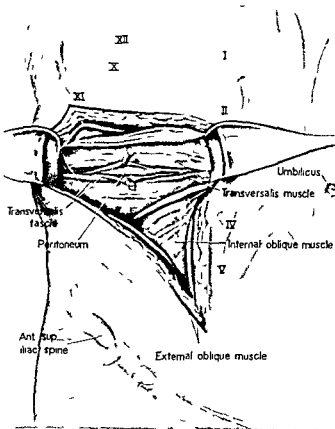


Fig 5

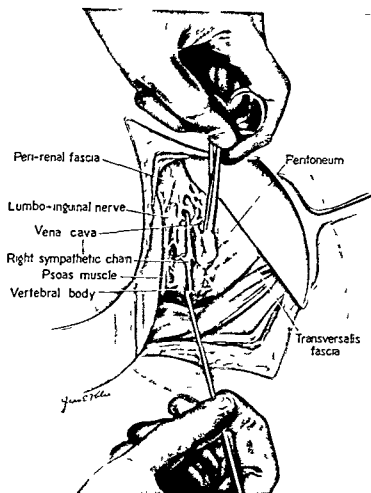


Fig 6 The retroperitoneal tissues have been separated from the underlying muscles with the hand. The Royle retractor is in place drawing the intact parietal peritoneum mesad. The vena cava has been freed of its surrounding connective tissue, mobilized and drawn mesad with the help of a mounted gauze sponge. The sympathetic chain has been thus exposed and is shown drawn taut by a blunt hook. At this level one sees the third ganglion with the rami directed transversely or caudad.

arch (Fig 7) to the brim of the pelvis. Royle uses a special psoas retractor with blunt teeth. If this is employed one must be careful to avoid tearing the muscle, as this may result in troublesome bleeding.

On the right side the vena cava usually lies directly over the sympathetic chain. It is best to mobilize carefully this vessel over its entire abdominal extent before beginning the sympatheticotomy. This may be done with a mounted sponge. It is not wise to draw it aside with the Royle retractor for fear of injury to it or its branches. As the vena cava is drawn mesad, the chain and rami are exposed. The ganglionated chain is intimately

bound to the fascia covering the vertebrae. It must be freed from its attachments using fairly forceful dissection. The chain is tough and taut, one of its most characteristic physical attributes. Small lumbar veins and arteries usually accompany the rami and pass anterior to it. These need not be divided. The chain may be drawn under them as the rami are severed, or the rami may be cut if necessary to facilitate its removal. Very little bleeding is encountered. If however, troublesome bleeding occurs in the depths and ligature is difficult, silver clips may be utilized. These have stood the author in good stead on several occasions.

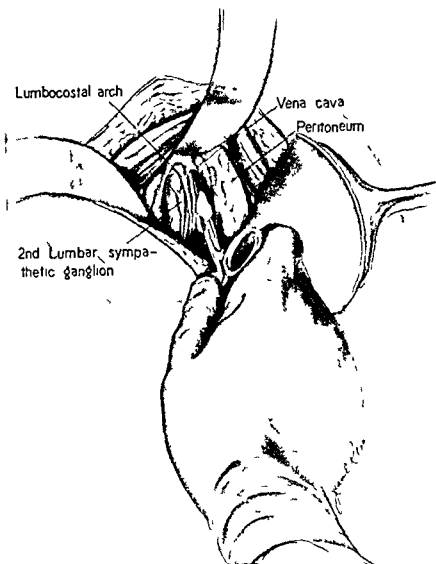


Fig 7 The retractors have been moved cephalad. Another retractor Deaver type has been placed so as to expose the upper limit of the chain as it disappears under the medial lumbocostal arch. The vena cava has been further mobilized and held mesad. The highest ganglion seen is the second. The first ganglion lies under the insertion of the crura. Note that the rami connected to the second ganglion are directed sharply cephalad, a fact which allows of its easy identification.

In identifying the sympathetic trunk we must be careful to distinguish it from the lumbar lymphatic vessels. An unusually low formation of the receptaculum chyli may make definition and mobilization of the trunk difficult. Small lumbar arteries must not be confused with rami communicantes. The abdominal trunk should be removed from above the second to below the fourth ganglion, severing all the rami communicantes. The arrangement of the ganglia is sometimes variable. Two adjacent ganglia may be fused, or ganglia may be missing. The identification of the ganglia depends primarily on which rami are attached to them rather than on their position

in relation to the vertebrae. In this way fusion of two ganglia may definitely be diagnosed. The second ganglion may be identified by the fact that its rami are directed sharply cephalad, whereas the rami of the third and fourth ganglia are directed caudad or transversely (3) (Fig 7).

Step 6 After the ganglionectomy and trunk resection the retractors are held in place while the entire field is washed thoroughly with warm saline solution. A large number of fat particles will float in the solution and should be removed. Any bleeding points are ligated carefully. The retractors are then removed and the tissues allowed to fall together. It is unnecessary to change the

apparent that negative results balance positive findings and in the majority the methods used are *entirely inadequate*. The indirect evidence supporting the possibility of hyperadrenal emia as the causative factor in hypertension is more substantial. The syndrome associated with chromaffin cell tumors is now well established and the literature in this field has been recently reviewed by Belt and Powell¹ and Collier, Field, and Durant.² Patients with these tumors have been found to display a paroxysmal hypertension together with other symptoms such as pallor, profuse sweating, dyspnea, headache, precordial oppression, bradycardia, nausea and vomiting. The origin of these tumors from the adrenal medulla, their histological appearance and brown staining after chromate fixation, the isolation from them of large amounts of epinephrine, and the similarity of the symptoms of the paroxysmal attack with those produced by an injection of epinephrine suggest that a sudden excretion of adrenalin is the proximal cause of the hypertension.

Qualified opinion with respect to the function of the adrenal medulla is still far from agreement, and this in spite of an enormous amount of careful experimental work. The tonus theory assumes that there occurs a steady and continuous secretion of epinephrine into the circulation in amounts sufficient to provide a minimal but constant stimulation of sympathetic nerve endings. As a result of this action on the vasoconstrictor nerves it is assumed that epinephrine thus plays a role in the maintenance of the normal blood pressure. A serious objection to the tonus theory arises from the fact that cats, dogs, and monkeys have been found to live indefinitely in good health after removal of one adrenal and complete denervation of the other, an operation

which reduces the output of epinephrine to an undetectable amount. Furthermore dogs and cats have been kept alive and in good condition after bilateral adrenalectomy by the administration of cortical extracts free from epinephrine. This evidence would prove that the adrenal medulla and its product epinephrine performed no significant function were it not for the fact that a considerable amount of extra adrenal chromaffin tissue exists in various parts of the body. The demonstration of epinephrine in paragangliomas arising from this tissue suggests that it has a functional capacity similar to the adrenal medulla. A frequently stated objection to the tonus theory, namely that minimum effective doses of epinephrine cause a fall rather than an increase in blood pressure and that when the dose is raised to a sufficient degree to produce pressor effects inhibition of the gastro intestinal tract results, has been recently found to be untenable. The depressor effect of small doses of epinephrine was demonstrated by C. A. Dragstedt, Wightman, and Huffman³ to be due to the anesthesia and that if measurements were made on the normal unanesthetized dog, the minimal effective dose of epinephrine on sustained intravenous injection caused an increase in blood pressure without inhibition of gastro intestinal motility. In recent experiments C. A. Dragstedt⁴ found that compatible suprarenal vein blood collected from one dog and reinjected into a second unanesthetized dog at the same rate at which it was collected produced a slight rise in blood pressure which was not secured by the injection of systemic blood. He concluded that the adrenals normally and constantly secrete epinephrine in amounts sufficient to modify the vascular bed and that a slight augmentation of secretion might easily produce hemodynamic effects

¹Belt A E and Powell T O. Surg. Gynec. & Obst. 1934 59 9.
²Collier F A, Field H and Durant T M. A. Ch. Surg. 1934 23

³Dragstedt C A, Wightman A H, and Huffman J W. Am J Physiol 1928 84 307.
⁴Dragstedt C A. J. Am. M. Ass. 1928 or 1935.

These observations provide very strong support to the tonus theory of medullo-adrenal function and at the same time remove some of the more formidable objections to the view that a hypersecretion of epinephrine may be the cause of hypertension. A more or less critical test of the theory has been recently made in the writer's laboratory.¹ A sustained hypertension for periods up to 2 weeks was produced in normal dogs by the continuous intravenous injection of epinephrine. The amount required, however, was sufficient to cause death from the other systemic effects of the hormone of which the inhibition of motility of the gastro-intestinal tract and the derangement in carbohydrate metabolism were probably the most important. Such findings make it appear very unlikely that long continued hypertension in man, in which the other systemic effects of epinephrine are usually absent, will be found to be due to hyperadrenalemia. The associated symptoms in cases of chromaffin cell tumors with paroxysmal hypertension have likewise been so severe that it does not seem possible that a patient could survive the persistence of so serious an attack. For the moment then it seems wise that there be no widespread adoption of these proposed surgical procedures for the treatment of hypertension and that it be incumbent upon those who now carry them out to make careful and long continued postoperative studies which may be considered in the light of the natural history of the disease.

LESTER R. DRAGSTEDT

CANCER OF THE BREAST

THERE is an increasing murmur of disappointment over the results of our campaign to control cancer of the breast. We have not decreased the death rate of the disease, and it has become doubtful that

we can do so, in the near future, by any means now at our disposal. The results of our present day treatment are described as no better than Halsted obtained 40 years ago. The time has come to review all the facts, both favorable and unfavorable to our management of breast cancer. We need a restoration of faith in our well established methods of treatment. The following considerations do this, even though they emphasize the unfavorable aspects of the situation.

The death rate from cancer of the breast in the Registration Area of the United States in 1903 was 5.5 per 100,000, in 1933 it was 9.9. Were it not for the fact that vital statistics were kept rather carelessly 20 years ago, these figures would seem to show that the death rate from breast cancer has nearly doubled in that time. Cancer of the breast is more easily recognized at death than any other common form of cancer. The statistics on its frequency are therefore likely to be trustworthy. There is no escape from the conclusion that it is at least as common a cause of death today as it was 2 decades ago, despite the intensive fight that has been waged against it. This does not of necessity mean that the fight has done no good at all—only that its results are not yet shown by the mortality rate. However, if the same criteria as to the success of measures designed to control an infectious disease are applied to the success of the measures heretofore used to control breast cancer, they indicate that the latter have accomplished next to nothing.

The radical operation for operable cancer of the breast in well known clinics gives a percentage of from 32 to 39 of 5 year cures. As Adair states, reports giving percentages much higher than these are to be looked on with suspicion. There seems to be no hope of improving the radical operation or of increasing its extent.

¹Prohaska, John Van Harms H. and Dragstedt L. R. (unpublished experiments)

Serious attempts to treat breast cancer by irradiation have been made for perhaps 20 years. The results of this treatment are not so well known as those of operation. The technique has not been standardized. There is difference of opinion as to the relative value of high voltage x ray and radium treatment. Breast cancer appears to be radioresistant and requires a dosage so heavy as to produce ulceration in some cases. Many roentgenologists lack the courage to give it. Adair states that irradiation 'cures' are produced by locking up the disease in dense fibrous tissue, and starving the disease process by endarteritis, and the direct insult to the cancer cell which is produced by the rays'. He reports 12 five year survivals of a series of 37 operable cases treated by irradiation methods only, a percentage of 36.3. This is one of the very few carefully studied series of cases so treated which I have been able to find. It is probable that these patients received about as good treatment as is possible in the present state of knowledge, and that the 36.3 per cent of 5 year cures is about the best that can be expected from irradiation alone. The same author reports 40.6 per cent of 5 year cures among 137 cases treated by combined operation and irradiation.

It is significant that the percentage of 5 year cures obtained by irradiation as the sole method of treatment is about the same as that obtained by operation alone. It is also significant that very few authorities on irradiation advocate it for operable cases except in combination with the radical operation. The writer has seen cases in which irradiation seemed to hasten the spread of the growth, also cases in which it caused a rapid disappearance of metastatic nodules. In nearly all cases irradiation will alleviate the pain of spinal metastases.

It is the usual experience of surgeons now-

adays that their patients die with no, or comparatively insignificant, recurrences in the field of operation. They die of internal metastases. Primary tumors, found with difficulty at autopsy, may produce massive and widespread metastases. Metastases may be found 15, 20, even 43 years after operation. Absolute proof of cure can be obtained only by autopsy. Some growths cause death within a period of 3 months.

Daland has shown that of 100 cases of untreated cancer of the breast 26 were living after 5 years. The term 'early case' is liable to be a misnomer. With improved methods and a diligent search we have been able to find axillary metastases in nearly all our apparently early cases. From all this it is evident that the vital characteristics of cancer of the breast are extremely variable. We must agree to the dictum that the fate of the patient is sealed before she comes to operation. Neither by operation nor by irradiation can we hope to destroy more than the local growth and its regional ramifications. Early operation is better than late operation but early operation is not so much better as we once thought it to be.

The foregoing facts must sober our thoughts regarding breast cancer, but they should not in the least destroy faith in our treatment of it. They warrant the following conclusions:

- 1 That radical operation combined with irradiation or alone will in nearly all cases rid the patient of the horror of the local growth. We now seldom see foul ulcerating tumors fixed to or invading the chest wall. Even if treatment produced no permanent cures at all it would still be a great blessing.

- 2 That in at least 33 per cent of all cases the vital characteristics of the growth so limit it that fairly early operation will be followed by survival for 5 years or longer.

They do not justify half hearted or perfunctory treatment, which we know by ample experience is worse than no treatment at all. The results of treating breast cancer are as good as those obtained by treating cancer of the cervix, and infinitely better than those

obtained by treating cancer of the stomach. We can hope for some improvement of our results from better methods of irradiation, but for any great improvement we must await fundamental scientific discoveries.

W D GATCH

MASTER SURGEONS OF AMERICA

ARCHIBALD CUNNINGHAM HARRISON

BORN near Richmond, Virginia, January 6, 1864, Dr. Harrison was fortunate in his parents and lineage, but unfortunate in the time and location of his birth, his mother at the time having been forced to leave her home because of Civil War battles in the neighborhood. Like many of his contemporaries from the South, the Civil War and Reconstruction Period prevented him from having the advantages he otherwise would have had. This is made the more easily understood by a visit to his boyhood home which, at one time, was occupied by Union troops and which is in a neighborhood where there was much heavy fighting. Here Stuart made some of his most dashing maneuvers and a few miles distant stand the handsome and famous Seven Pines.

On his father's side he was descended from a long line of distinguished ancestors including Benjamin Harrison, Councillor Robert ("King") Carter, Archibald Cary, and the original William Randolph. His mother was the daughter of Benjamin Watkins Leigh, noted lawyer and political figure of his time, and Julia Wickham, granddaughter of John Wickham, the lawyer who defended Aaron Burr. Dr. Harrison's father was Dr. Thomas Randolph Harrison, a physician of varied knowledge, great resource, and with many of the characteristics later seen in his distinguished son. Though a country doctor without facilities, he was remarkably successful in surgery, and it was his enthusiasm and success that influenced the son to be a surgeon. The son also inherited the father's love for natural history.

Julia Wickham Leigh, his mother, was a woman of fine force of character and known for her large fund of information, the result of unusually wide reading.

Dr. Harrison's early education was obtained in a log cabin public school, a private school near his home, one year in a boarding school at Winchester, Kentucky, and one year at Hanover Academy, Virginia. His medical education was obtained at the University of Virginia and the University of Maryland. He was graduated at the latter school in 1887. Upon graduation, he was appointed interne at Bay View Hospital (now The City Hospitals) and when the Johns Hopkins Medical School opened, he worked for a short time in its dispensary under Dr. Halsted. Though this connection was brief, it aroused in him an admiration for Dr. Halsted and his work that constantly increased, was a constant inspiration, and undoubtedly influenced his conception of surgery as did his work under Dr. L. McLane Tiffany.



ARCHIBALD C HARRISON
1864-1926

2

Feeling that he had to obtain a living wage quicker than he saw opportunity of doing in Baltimore, in 1890 he went to Meyersdale, Pennsylvania, and did general practice there until 1898. During this period, he did all the surgery that came to his hand, but ever with a desire to get back to Baltimore and a larger field with greater opportunities for development. Finally the temptation could be withstood no longer and he returned to start afresh at the age of 34 years. In 1892, Dr. Harrison married Anna Warfield of Howard County, Maryland. By this marriage, there were three daughters. The relationship that existed in this happy family was an ideal one. In the working world, his hands were not always gloved, but in his home he was the ultimate in gentleness, consideration, and good humor.

Promptly after his return to Baltimore, Dr. Harrison took up the study of anatomy, and night after night worked in the dissecting room at the College of Physicians and Surgeons until two or three o'clock in the morning. His industry and his knowledge of anatomy soon obtained for him the position of an assistant demonstrator, and in a few years it was recognized that he had mastered anatomy as few surgeons do.

In 1901, he was made demonstrator of anatomy, and in 1902 was put upon the visiting staffs of surgeons of Mercy and Bay View Hospitals, thus giving him also some clinical opportunities. In 1903, he was made associate professor of surgery and anatomy. In 1908, he was made professor of anatomy and clinical surgery, and in 1913, professor of surgery. In 1915, the College of Physicians and Surgeons combined with the University of Maryland and he retained his last title until his death. In 1908, he was made a visiting surgeon to St. Joseph's Hospital and after this, there followed appointments to the staffs of the Church Home and Infirmary, the Hospital for the Women of Maryland, the Baltimore Eye, Ear and Throat Hospital, and the South Baltimore General Hospital.

Dr. Harrison was peculiarly fitted by nature to be a surgeon. His appearance, his calmness, his carefulness, thoroughness, resource, courage, and judgment were a foundation upon which he built by hard work, careful preparation, and deep thought.

The excellent courses given in the primary subjects of medicine at the University of Virginia, particularly in anatomy, the clinical work he saw at the University of Maryland and Bay View, the miscellaneous work he had in general practice, his training in the dissecting room, the clinical facilities he was given, were all made the most of and were seed sown upon fertile soil, so that when his larger opportunity came, it found him prepared with an excellent ground work.

Dr. Harrison's knowledge of anatomy plus his calm, deliberate manner of operating and his perfect technique, enabled him to do surgery with a precision and exactness rarely equalled. The ordinary operations that he did repeatedly were done splendidly—one feels like saying perfectly—but it was in the extraor-

inary procedures that he shone most brilliantly. Given a condition for which no definite operative procedure was described, he took pleasure in thinking out a method and line of approach and would carry through the operation, nearly always just as he had planned it. In his vigorous years, he seemed to revel in difficult operations and particularly in those requiring careful anatomical dissection.

As a surgeon, he deserves the highest rank. As a diagnostician, he shone not only in surgical conditions, but medical conditions as well, making his advice particularly valuable in puzzling, borderline cases. A large part of his diagnostic ability was due to his unusual skill in obtaining the patient's history. As an operator he had few equals—the same thoroughness and care observed in the diagnosis were used here. He admired the painstaking, deliberate type of surgeon and was bitter against the operator who tried to be rapid, at the sacrifice of technique and a regard for tissues.

Perhaps Dr. Harrison's greatest service to his profession and the public was his firm stand for this type of surgery. Who can say how far this influence is felt? There are surgeons taught by him as students and internes practicing in all parts of the Union. He had a very high ideal in surgery and he came nearer to his ideal than falls to the lot of most men. The exactness and neatness of his work, plus the beautiful exposures and careful dissections, made his operating taxing and tiring, but he lived up to his ideal or deviated from it only when speed was absolutely essential. Then, contrary to the opinion of many, he could work quite rapidly.

In certain types of work, for instance, bone surgery or large difficult dissections, like tumors of the neck, jaw or tongue, and many other conditions, the writer has not seen his superior in any clinic. In postoperative treatment he gave his time unsparingly—was skillful and resourceful.

Dr. Harrison had, in a remarkable degree, the power to separate the wheat from the chaff in surgical measures and could almost unfailingly pick out among the new suggestions, the ones that would last and the ones that would be discarded. He was not a research worker, but his ability to sift confusing and complex evidence and to arrive at a clear, concrete verdict was well known and his advice and judgment were constantly sought by surgeons and practitioners and frequently by lawyers who had medicolegal problems. By a large group of younger men, he was consulted freely regarding all manner of problems, and his advice was always logical and clear. As in the home, so with his patients he was gentleness itself—particularly with women and children and the very ill, but woe to the man who was a coward or a malingerer!

It is a pleasure to remember the many pleasing and admirable characteristics of Dr. Harrison—his personal attractiveness, his honesty and integrity, his courage, his humor, his forthrightness (and, upon justification, his ferociousness).

As a man he met things squarely, and of those who did not, he was, particularly in his later years, somewhat critical. When this is said, the indictment of faults is complete, and it might be said in extenuation that many of his estimates were, in due time, found to be true. His criticisms, however, were limited to man. He had a great love of animals and he knew a great deal about them, as he did also about trees and about birds. He had unlimited admiration for nature and for her laws.

His achievements are the more to be admired when it is realized that his surgical career was really a short one. He returned to Baltimore in 1898. It necessarily took him a few years to obtain a foothold and his work, like that of many others, was seriously interrupted by going overseas in 1917. After his return in 1918, he accomplished a great deal, but he knew his cardiac condition had to be favored and he did not exert himself as he had previously done.

The period of 1906 to 1917 was the flood tide of his career. During this time, he accomplished an enormous amount of work, but no matter how rushed he was, how many operations he had posted, each one had to be done as though it were the only one posted that day.

Though it was always difficult to persuade him to write, in these years, he appeared rather frequently before medical organizations, and in 1906 was elected president of the Baltimore City Medical Society and in 1913 was made president of the Medical and Chirurgical Faculty of Maryland.

When America entered the war, Dr. Harrison promptly offered his services by going to Washington and asking to be allowed to organize a small mobile unit of some type. This offer was refused and the refusal led him to make some statements to the then Chief of the Red Cross that made the writer, who was present, feel rather uneasy, but apparently no offense was taken, for he was urged to organize a Base Hospital which he, at the time, thought could not be done. It is another instance of the clearness of his judgment that the type of unit he wanted to organize was eventually found to be essential and Base Hospitals were largely broken up to form such teams. Later, the University of Maryland Unit was organized as Base Hospital No. 42 with Dr. Harrison as director. At this time he was given the rank of Major, later he was made a Lieutenant Colonel and after the War he entered the Reserve as a Colonel. Organizing and commanding Base Hospital No. 42 and doing such excellent work abroad was considered by his friends as being an outstanding achievement, but he rarely referred to it and never once mentioned any hardships or stress that he must have undergone. When he found himself in failing health, he never intimated that the War had anything to do with it, except to say he thought an attack of influenza, suffered while in France, had done him harm. After he returned to this country he received a citation from General Pershing for "especially meritorious and conspicuous service at Base Hospital No. 42, France."

Dr Harrison was a strikingly handsome man, of a large upstanding figure and a commanding presence. In his youth and early manhood, he was very athletic, being a good swimmer, a crack shot and so successful in amateur baseball that he was offered a position on a professional team. Possessing a keen sense of humor, being quick at repartee, a good story teller and having a great fund of accurate information, made him a most entertaining and instructive conversationalist. He was a great lover of nature and no recreation was so pleasing to him as roaming through the woods or fields, observing the birds, trees, and animals about which he knew so much.

Though always having the desire for it, extensive general reading was to a large extent denied him in the years when he was developing himself as a surgeon, but in later years, this pleasure came to him in full measure. He read discriminatingly, extensively, and in the same manner that he had read surgery, slowly, carefully, with deep insight and by no means always accepting the author's conclusions.

His father, having lived to the age of 81 and his mother to the age of 87, the life expectancy of Dr Harrison should have been more than the allotted three score years and ten, but his tragic death occurred a few days after the completion of his sixty second year. In his passing, his immediate family and large family connection lost their idol. The surgical profession lost a clear thinker, a lucid teacher, a master surgeon.

He, "in every storm of life was oak and rock, but in the sunshine, he was vine and flower."

WALTER D WISE

LANDMARKS IN SURGERY

TROUSSEAU AND THORACENTESIS

JEROME R. HEAD, A.M., M.D., Chicago, Illinois

IN 1863 in his "Clinique Médicale de l'Hôtel Dieu," Armand Trousseau summed up his contributions to the operation of thoracentesis in a passage which is a unique and dignified expression of man's desire to have contributed permanently to the work to which he has devoted himself.

"One will render me, I hope, this justice," he wrote, "that I rarely speak of myself and that for my part I generally attach little importance to questions of priority. I may then once in passing give to myself the credit due me in the matter of paracentesis of the chest. I make no pretension to having conceived it, I have invented no special instrument to facilitate the operation, I have not advised any operative procedure which was not already perfectly well known, but I believe that I was, if not the first, at least one of the first, to have formulated the necessity of paracentesis of pleurisy with excessive effusion. I established with precision, perhaps with more precision than any one before me, the indications, and finally, I believe that I popularized a method which has now been generally adopted. For these reasons I consider that I have contributed somewhat to the progress of the treatment of pleurisy."

Trousseau read his first communication on paracentesis for pleurisy with excessive effusion before the academy of medicine of Paris in 1843, and the year following cited additional cases.

Trousseau's rôle in the development was that of the clinician and the popularizer. He stressed the fact that pleurisy with excessive effusion was frequently the cause of sudden death from pulmonary embolism and that chronic persistent effusions occasionally left the lung permanently crippled and the thorax distorted. He noted that dyspnea was a misleading symptom, frequently being absent in the presence of large and dangerous accumulations. He said that the entrance of air was not to be feared, nor the rapid withdrawal of large amounts of fluid. He

did not realize that he could safely do the latter only because he permitted air to equalize the pressure.

The indications for thoracentesis came gradually to be recognized, and then, as is so often the case, to be extended and abused.

Gradually the pendulum swung back. Aspiration today is done diagnostically or only for excessive effusions or those unduly chronic. Sudden death from embolism, and calcification of the pleura, are the complications it can and should prevent. Recognition of the facts that most simple pleurisy is tuberculous and that collapse of the lungs favors the healing of the basic pulmonary lesion has led men to regard the effusion as of therapeutic value and in some instances, when the causative pulmonary tuberculosis is at all advanced, to prolong the collapse which the fluid has initiated by replacing it with air.



Armand Trousseau
1801-1867

During the middle decades of the 19th century, Armand Trousseau was the foremost teacher, clinician, and consultant in Paris. Paris and Dublin were then the medical centers of the world. At a time when the theory and practice of medicine were undergoing revolutionary changes, he was the chief advocate of the new order and his clinics at l'Hôtel Dieu, attended by students and physicians from all nations, became a fountain head whence the best and latest in medical thought was disseminated throughout the world. And yet this man whose career was so brilliant, who in his own right won and filled the highest position in his profession, cannot be considered—in fact never considered himself—as more or greater than the pupil of a greater man. Nowhere in medical literature is there an example of a more ideal relationship between master and pupil than was that between Bretonneau and his disciples, Trousseau and Velpeau.

Much that men do is done to justify the expectations of those whom they love and respect, and Bretonneau, one of the truly great physicians, had the

The Figure of an actual catery with its plate fit to be used in a Pleurisy

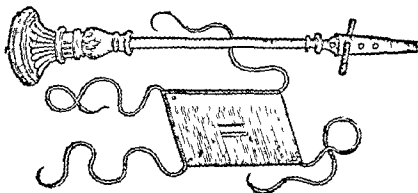


Fig 2 Instrument

rare quality of inspiring such devotion. Throughout his life Trousseau lived to justify the hopes this man had for him, writing to him regularly of his work, plans, hopes, problems, and in his clinics preaching his doctrines and popularizing his achievements.

Trousseau's first meeting with Bretonneau determined the course of his subsequent career. At the age of twenty, having completed his studies at the Lycee d Orleans and the College of Lyons, he had attained the position of professor of rhetoric at the College of Chateauroux. Shortly after receiving this appointment he chanced to meet Bretonneau at the home of a friend. A mutual sympathy and appreciation must immediately have been discovered, for at the end of their first conversation the older man urged Trousseau to abandon teaching and study medicine. Trousseau followed the advice and the next two years spent on Bretonneau's service at Tours. At this time writes Gomez, "when Bretonneau by his studies had already arrived at an understanding of diphtheria and typhoid fever he became his favorite pupil, the assistant in his work, the depository of his hopes, the witness of his success." Trousseau filled himself with the ideas of his master and assimilated his doctrines, and it was these which he carried with him to Paris and which presented with his natural eloquence and communicative ardor revolutionized medical thought and were the source of his reputation and of the originality of his teachings.

In 1825 Trousseau proceeded to Paris to continue his studies and to take his examinations for the doctorate. Having passed these and completed his thesis he wrote to Bretonneau, "I received the most flattering compliments from M. Recamier and M. Guersant, and I trust therefore that I have shown myself not less worthy of you than Velpeau and Cottereau." At this period, as throughout his life, his own success seemed important chiefly because it pleased and justified his master.

For every medical student the years following graduation are the most difficult and important. They were for Trousseau. He lacked money to continue his studies and was faced with the important problem of choosing a location for practice and deciding on the direction of his career. Velpeau persuaded him to take the examinations for admission to the faculty. It was a question of remaining in Paris and following the hard road of ambition or of returning to Tours and its easier and more pleasant ways. He wrote to Bretonneau, "If I am turned down, perhaps it will be for the best, if I am chosen perhaps that will be even better. The road of ambition being opened to me, I shall hurl myself into it with fury and in spite of all obstacles it may be that I shall arrive. But if the door of the school is closed to me, I shall consider myself quite happy to return to the depths of my province and there pass more good moments in six months than in ten years in this more brilliant theatre."

He finally decided that whether he was received or not, he would return to Tours. Bretonneau wrote to him, "What madness has taken possession of you to bury yourself in this hospital when so fair and noble a career is open to you?" To this Trousseau replied, "I see it all clearly. I shall be appointed an *agrégé*. I shall sacrifice all to my reputation, to my advancement and in fifteen years I shall be one of the twenty-two professors of our faculty. I shall be forty years old, my life three-fourths used, I shall know nothing of medicine and shall begin to acquire a clientele. I shall be quite satisfied and quite glorious. And my happiness my dear master? You smile? What difference does that make?"

At Trousseau's continued solicitations Bretonneau secured for him the appointment as a surgeon at the hospital of Tours. And then when all was apparently decided, Trousseau passed his examination and determined to remain in Paris. Bretonneau was irritated and hurt. Permit me, he wrote, "A reflection

which is authorized by the paternal affection which I bear you and by my experience of life, the most important part of a man, that which is of the most intrinsic value, is neither his ability, his knowledge, or his talent, it is his character."

This was in 1826. The struggles that Trousseau had anticipated in Paris became real and it was not until 1839 when he was thirty-eight years old, that he finally secured the chair of therapeutics. In 1852 he reached the goal of his ambition and was appointed chief of the Clinique Médicale de l'Hôtel Dieu. One can believe that the dissipation of his energies irked him and that at times he grew "tired of knocking at preferment's door." When he had finally arrived, as he felt certain that he would, he could still write to Bretonneau in the tone of his earliest letters, "as the years pass, my life arranges itself more and more unsatisfactorily and I am now hurled into a medical whirlpool which prevents me from being a physician. However much I wish to escape from the distractions of the role, I am caught in the gears and all passes. The compensations of self-esteem and money are little in comparison to the ennui which it all causes me, and I realize that no escape is possible save one that is complete. I fight, paralysis or death—those are my three ports of refuge, and it is not gay—"

In 1863 he resigned from his position at l'Hôtel Dieu and again took the chair of therapeutics. In 1866 he relinquished this also. It is probable that he

already felt the beginnings of his last illness, for on June 23, 1867, after a long and painful decline, he died of cancer of the stomach. Bretonneau had preceded him by only four years and Velpeau followed him in a few months.

Trousseau contributed greatly to the progress of medicine in the 19th century—not by his original contributions, for these were negligible—but by his persistent, impassioned, and successful advocacy of the new ideas of other men. Most of these he had obtained from Bretonneau, a few, like thoracentesis, he acquired elsewhere.

Had Trousseau returned to Tours instead of remaining in Paris, it is possible that he would have contributed originally to medicine and come nearer to realizing his true ambitions. The strife and distractions incident to winning preferment in a great center are rarely conducive to original thought. But be that as it may, his energy and talents were exactly suited to the role he chose. His enthusiasm, his courage, his gift of rhetoric combined to make him the popularizer par excellence, and it is as the disciple of Bretonneau and the advocate of the ideas of other men that he must be remembered. To say this is not to dispraise him. In all phases of human activity, such men are important and indispensable, for were it not for their imagination in recognizing the good in the new work of others and their energy in demonstrating and proclaiming it, progress would be seriously delayed.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE technique of urography the 'normal and all the abnormal conditions of the urinary tract, are covered in the manual on urological roentgenology by Wesson and Ruggles.¹ In order to develop a logical basis for the roentgenological findings each condition is discussed briefly but concisely with the excellent illustrations such a scheme of discussion makes this a practical handbook.

The authors introduce a rather unique method of combined retrograde cystoscopy and ureteral catheterization with intravenous urography after the ureteral catheters are passed their ends are plugged and the intravenous urographical material is administered and roentgenographical studies are made at stated intervals. If unsatisfactory plates are obtained retrograde urography is executed. The authors recommend an absolute use of the gravity method for the injection of the upper urinary tract with media. They believe, as most urologists do, that retrograde urography is still more valuable than intravenous urography.

The chapter embodying a discussion and illustration of urogenital infections is particularly elucidating and outstanding, urinary tuberculosis is correctly given a most important place. Renal tumors afford the opportunity for an excellent discussion and display of roentgenological studies. Traumatism of the urinary tract and the principles which govern their roentgenological studies is expertly discussed the authors have apparently had much experience with this group of urological patients.

This practical manual can be recommended to medical students and practitioners whole heartedly. Most urologists would do well to read the book too.

WILLIAM J. BAKER

A FAIRLY complete review of the modern stage of gynecological radiotherapy is given in a recent monograph² written by the radiologist of the Centre Anticancereux in Bordeaux which is one of the greatest cancer centers in France.

After a brief chapter on the physics and biology of gynecological radiotherapy and of the most important clinical facts to be considered in its application the radiation treatment of benign lesions of the female generative organs is discussed, including the treatment of functional disturbances. After a short chapter on the radiation treatment of inflammatory conditions of the female genital organs the largest part of the remainder of the book is devoted to the

treatment of malignant tumors. A final chapter deals with the radiation treatment of cancer of the breast.

For those who read French this book is a convenient guide for information as to the present conditions of the application of radium in the different diseases of the female genital organs, of their indications and limitations. Its tenor is inspired by the leading ideas of the French school although the author also discusses some of the modern foreign methods and accomplishments.

Obviously, the best parts of this book are those based on the author's own experience and on the experience of the Paris school, and it would have been an advantage rather than a loss to the book if the author had limited himself to these parts. The choice of references to the methods of other authors in a book of this type cannot be complete in any case. This choice sometimes seems fairly arbitrary in so far as it is too short in most instances for complete reference information and on the other hand it lessens somewhat the advantages of a purely subjective textbook.

The book is completely brought up to date. Sometimes one has the impression that it is too modern, in so far as it includes methods whose definite value is not yet definitely established.

In general this book gives a very good survey of the indications and limitations of radiation therapy in these conditions. Especially the discussion of the treatment of cancer of the uterus can be endorsed in every detail. It is valuable to have the scattered information of the results of radiation therapy of cancer of the cervix in leading radiologic clinics in their comparison to surgical results collected here in a convenient form. In addition to the value of this book as a convenient source of brief information about the questions related to gynecological radiotherapy, the possibility that it may advance the knowledge of the facts of the accomplishments of radiotherapy in these conditions greatly enhances its original worth. In no country are these facts well enough known and certainly not enough appreciated by many of the surgical gynecologists.

There is an extensive bibliography appended.

MAX CUTLER.

THE author H. Jessen dedicates his work³ on cytology of the cerebrospinal fluid to Paul Ravaut whom he calls the father of the cytology of the cerebrospinal fluid. The book is divided

¹ UROLOGICAL ROENTGENOLOGY. A MANUAL FOR STUDENTS AND PRACTITIONERS. By Miley B. Wesson M.D. and Howard E. Ruggles M.D. Philadelphia: Lea & Feb. 1930.

² RADIOTHÉRAPIE GYNÉCOLOGIQUE. CURIE ET ROENTGENTHÉRAPIE. By R. Mathéy Corrat. Paris: Masson et Cie. 1930.

³ CYTOLOGIE DU LIQUIDE CÉPHALO-RACHIDIEN NORMAL, CHEF & HOMME. MONOGRAPHIE CRITIQUE ET PRATIQUE. By H. Jessen. Paris: Masson et Cie. 1930.

into three parts, morphology, enumeration, and cytophysiology. All discussion is limited to normal fluid. Jessen describes the methods of studying the cells, immediate or delayed, with or without centrifugation, or by precipitation in their natural state or after fixing and staining as in hematology, or by the "vital" or "supravital" methods. To study the cells in detail he recommends the Alzheimer, Ravaut, Forster, Cunningham-Kubie, Einstein Ostertag, and the Fischer, Kafka, Jessen techniques, pointing out that all have defects and limitations. He concludes that in the cerebrospinal fluid one finds only mononuclear cells, polymorphonuclears, and that others are rare and accidental. The mononuclears consist of small round cells, large round cells, polygonal cells, and intermediary forms. The first type is preponderant in number. Jessen indicates that these cells undergo cytolysis *in vivo* as well as *in vitro*, the rate in any one individual varying. This explains the variability in reported counts.

To study the number of cells in the normal patient, the author uses large series, examining quantities of fluid in a Glaubermann chamber which contains a volume of 20 cubic millimeters. He points out the danger of gross error in smaller chambers and advises not coloring the fluid for the count, but adding formalin to preserve the cells (1 part to 19 parts of fluid to make a 5 per cent dilution). The author considers up to 5 cells per cubic millimeter as normal, 5 to 10 as suspicious, and over 10 as pathological.

As for the origin of the cells, he indicates that the fluid is principally a secretion from the cerebral ventricles and that there are few if any cells there. An admixture of cells occurs as the fluid descends the arachnoid sac. This is "easily understood" because the cerebrospinal cavity has a large surface, and is traversed by trabeculae rich in cells. Conditions are optimum for an admixture of cells into the fluid as it passes downward. As indicated before, the cells are chiefly lymphocytes, although others may be epithelial cells or histiocytes. The author believes that the cells are accidental elements in the fluid and serve no physiological function. There is no normal "threshold" for these cells, the limit between the normal and a pathological pleocytosis being variable. Jessen warns that what may be normal for one, may be abnormal for another, despite the general rules, and that all the other findings, the Wassermann, protein studies etc., must be considered before deciding that a given pleocytosis is significant.

In general it may be said that the author has offered little that is new except to emphasize certain cautions, especially as regards the importance of studying the formalin fixed cells in a large chamber. Of value is a good review of the literature and a critical evaluation of the various methods of study

of the cytology of the cerebrospinal fluid. An excellent bibliography on the subject of cerebrospinal fluid, comprising 20 pages, is appended to the volume.

BENJAMIN BOSHERS

WITH the recent increase in the clinical knowledge and surgical treatment of diseases of the thorax, there has developed a need on the part of both the physician and the surgeon for a more detailed consideration of thoracic anatomy than is afforded by general texts and atlases. *Le Thorax*,¹ by Hovelacque, Monod, and Evrard, meets this requirement. Besides being an excellently illustrated descriptive text, it presents adequate discussion of controversial theoretical points and of all variations from the normal. The illustrations, which are the most important and practical part of any work on anatomy, are in the best traditions of the art and are so numerous that there is scarcely an area that is not depicted from many angles. As a reference book it should be of constant service to the physician, the surgeon or the roentgenologist who is working in the field.

JEROME R. HEAD

AN ADMIRABLE guide for undergraduates, house surgeons, and young graduates in practice is provided in *Operative Surgery*, by Miles and Wilkie.² In this, the second edition, the text has been brought up to date. With the aid of their coadjutors, Miles and Wilkie have presented a condensed and forceful picture of the present day practice in the Edinburgh School. As each page contains the valued observations and advice of experienced and accomplished surgeons, it will also be read with interest and profit by more mature surgeons. While no pretense is made for completeness, all the more common operations are described. The 329 illustrations are graphic and informative. The short summaries of the regional anatomy are excellent indeed.

In such a worthwhile book as this, it would seem poor taste for the reviewer to pick out very minor points for adverse criticism. None the less it is to be hoped that the description of direct blood transfusion by metal cannula from donor to patient will be omitted from the next edition. The reviewer regretted not finding mention of the Orr treatment of osteomyelitis and was somewhat pained at the idea of giving calomel or castor oil on the third day after an abdominal operation.

Miles' and Wilkie's *Operative Surgery* is a useful and valuable book and can confidently be recommended.

FREDERICK CHRISTOPHER

¹ LE THORAX. ANATOMIE MEDICO-CHIRURGICALE. By Pr. Hovelacque, Oliver Monod, and Henri Evrard. Paris: Librairie Maloine 1917.

² OPERATIVE SURGERY. By Alexander Miles M.D. LL.D. F.R.C.S. (Ed.) and D. P. D. Wilkie M.D. F.R.C.S. (Ed and Eng.) 2d ed. London: Oxford University Press 1936.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE technique of urography, the 'normal and all the abnormal conditions of the urinary tract, are covered in the manual on urological roentgenology by Wesson and Ruggles.¹ In order to develop a logical basis for the roentgenological findings, each condition is discussed briefly but concisely with the excellent illustrations such a scheme of discussion makes this a practical handbook.

The authors introduce a rather unique method of combined retrograde cystoscopy and ureteral catheterization with intravenous urography after the ureteral catheters are passed their ends are plugged, and the intravenous urographical material is administered and roentgenographical studies are made at stated intervals. If unsatisfactory plates are obtained, retrograde urography is executed. The authors recommend an absolute use of the gravity method for the injection of the upper urinary tract with media. They believe as most urologists do, that retrograde urography is still more valuable than intravenous urography.

The chapter embodying a discussion and illustration of urogenital infections is particularly elucidating and outstanding urinary tuberculosis is correctly given a most important place. Renal tumors afford the opportunity for an excellent discussion and display of roentgenological studies. Traumatism of the urinary tract and the principles which govern their roentgenological studies is expertly discussed, the authors have apparently had much experience with this group of urological patients.

This practical manual can be recommended to medical students and practitioners whole heartedly. Most urologists would do well to read the book too.

WILLIAM J. BAKER

A FAIRLY complete review of the modern stage of gynecological radiotherapy is given in a recent monograph² written by the radiologist of the Centre Anticancereux in Bordeaux which is one of the greatest cancer centers in France.

After a brief chapter on the physics and biology of gynecological radiotherapy and of the most important clinical facts to be considered in its application, the radiation treatment of benign lesions of the female generative organs is discussed, including the treatment of functional disturbances. After a short chapter on the radiation treatment of inflammatory conditions of the female genital organs the largest part of the remainder of the book is devoted to the

treatment of malignant tumors. A final chapter deals with the radiation treatment of cancer of the breast.

For those who read French this book is a convenient guide for information as to the present conditions of the application of radium in the different diseases of the female genital organs of their indications and limitations. Its tenor is inspired by the leading ideas of the French school, although the author also discusses some of the modern foreign methods and accomplishments.

Obviously, the best parts of this book are those based on the author's own experience and on the experience of the Paris school and it would have been an advantage rather than a loss to the book if the author had limited himself to these parts. The choice of references to the methods of other authors in a book of this type cannot be complete in any case. This choice sometimes seems fairly arbitrary, in so far as it is too short in most instances for complete reference information and on the other hand it lessens somewhat the advantages of a purely subjective textbook.

The book is completely brought up to date. Sometimes one has the impression that it is too modern, in so far as it includes methods whose definite value is not yet definitely established.

In general this book gives a very good survey of the indications and limitations of radiation therapy in these conditions. Especially the discussion of the treatment of cancer of the uterus can be endorsed in every detail. It is valuable to have the scattered information of the results of radiation therapy of cancer of the cervix in leading radiologic clinics in their comparison to surgical results collected here in a convenient form. In addition to the value of this book as a convenient source of brief information about the questions related to gynecological radiotherapy the possibility that it may advance the knowledge of the facts of the accomplishments of radiotherapy in these conditions greatly enhances its original worth. In no country are these facts well enough known and certainly not enough appreciated by many of the surgical gynecologists.

There is an extensive bibliography appended.

MAX CUTLER.

THE author H. Jessen dedicates his work³ on "Cytology of the cerebrospinal fluid to Paul Ravaut whom he calls the father of the cytology of the cerebrospinal fluid." The book is divided

¹UROLOGICAL ROENTGENOLOGY. A MANUAL FOR STUDENTS AND PRACTITIONERS. By Miley B. Wesson, M.D. and Howard E. Ruggles, M.D. Philadelphia, Lea & Feb. 1936.

²RADIOTHERAPIE GYNÉCOLOGIQUE. COURS ET ROENTGÉNOGRAPHIE. By R. Mathéy Cornat. Paris, Masson et Cie. 1936.

CYTOLOGIE DU LIQUIDE CÉPHALO-RACHIDIEN NORMAL CHEF L. BONNE. MONOGRAPHIE CRITIQUE ET PRATIQUE. By H. Jessen. Paris, Masson et Cie. 1936.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York, *President*

FREDERIC A. BESLEY, Waukegan, *President Elect*

VERNON C. DAVID, *Chairman*, MICHAEL L. MASON, *Secretary*, *Committee on Arrangements*

PRELIMINARY PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

IN the following pages there appears a preliminary schedule of operative clinics and demonstrations at the hospitals and medical schools as prepared by the Committee on Arrangements for the twenty seventh annual Clinical Congress of the American College of Surgeons to be held in Chicago, October 25-26. It will be noted that clinics are being arranged for the afternoon of Monday, October 25, and for the mornings and afternoons of each of the four following days. Published in tentative form at this time, the clinical program will be revised and amplified during the months preceding the Congress.

In addition to an ample and well-arranged schedule of operative clinics that will demonstrate the technique of a wide variety of surgical procedures, the Committee is arranging a series of demonstration clinics at the medical schools and in the larger hospitals for the presentation of work being done in many special fields such as neurosurgery, traumatic surgery, thoracic surgery, fractures, plastic surgery, cancer, orthopedics, genitourinary surgery, obstetrics and gynecology, physical therapy, roentgenology, etc.

The Committee expects to so correlate the program that the visiting surgeon may be assured of an opportunity to devote his time continuously, if he so wishes, to clinics dealing particularly with the special subjects in which he is most interested. For example, it is planned to arrange so that fracture clinics will be available each forenoon and afternoon during the Congress, and similarly clinics and demonstrations in many special subjects.

The surgeons of Chicago, under the leadership of a strong and representative Committee, expect to provide a program of clinics and demonstrations that will present a complete showing of the clinical activities in all departments of surgery in this great medical center.

The Committee is assured of the hearty cooperation of the clinicians at the five medical

schools and more than fifty hospitals that will participate in the clinical program.

The Executive Committee in charge of arrangements is as follows:

VERNON C. DAVID,
Chairman
MICHAEL L. MASON,
Secretary
FRED I. ADAIR
RALPH B. BETTMAN
ALFVANDER BRUNSCHWIC
FREDERICK CHRISTOPHER
WARREN H. COLE
EDWARD L. COMPERT
JOHN S. COULTER
WILLIAM R. CUBBINS
HARRY CULVER

LOYAL DAVIS
GEORGE DE TARANSKY
LESTER R. DRAGSTEDT
HARRY S. GRADLE
M. J. HUBENY
SEYMOUR W. McARTHUR
KARL A. MEYER
ALBERT H. MONTGOMERY
OSCAR I. NADIAU
DALLAS B. PHEMISTER
SAMUEL SALLINGER
C. F. SAWYER

In addition to an extensive schedule of operative clinics and demonstrations at the hospitals prepared by the sub-committees on ophthalmology and otolaryngology, it is planned to arrange for two evening sessions at the Stevens Hotel at which visiting ophthalmologists and otolaryngologists will present and discuss papers of interest to those who specialize in these particular fields.

In the following pages will be found a preliminary outline of the programs for the scientific sessions to be held each evening in the ballroom of the Stevens Hotel, as prepared by the Executive Committee of the Board of Regents. At the opening session on Monday evening the retiring president, Dr. Eugene H. Pool, of New York, will deliver the presidential address and inaugurate the new officers—Dr. Frederic A. Besley, of Waukegan, president, Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schunheim, of Vancouver, vice-presidents. Also at this session the 1937 class of initiates will be received into Fellowship in the College.

As they so faithfully depict clinical features of major interest to surgeons, the showing of surgical motion picture films will be continued at this

year's session with an enlarged program of both sound and silent pictures to be exhibited daily at headquarters.

Headquarters for the Congress will be established at the Stevens Hotel where the grand ballroom with its large foyers and other meeting rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments x-ray apparatus, operating room lights, hospital apparatus and supplies of all kinds ligatures dressings, pharmaceuticals and publishers of medical books will be represented.

AFTERNOON SESSIONS

A series of five conferences to be held at headquarters has been planned for the afternoons of Tuesday, Wednesday, Thursday and Friday.

On Tuesday afternoon under the auspices of the Committee on the Treatment of Malignant Diseases, a cancer symposium will be held, dealing largely with scientific and clinical phases of the cancer problem rather than with organization and administrative problems. An important phase of this conference will be the presentation of five year cures on cancer that will have been compiled by the Department of Clinical Research from statistics furnished by surgeons, pathologists and radiologists as individuals or as members of hospitals and clinics. Added to the 24,440 five year cures reported by the College in 1934 the figures to be presented should reach an imposing magnitude.

On Wednesday afternoon there will be two symposia, one devoted to obstetrics and gynecology and one to graduate training for surgery. In the former there will be presented papers dealing with the clinical phases of obstetrical and gynecological work which will be of interest not only to those who combine their work to these special fields but also to those whose general work leads them into these fields. Leaders in these specialties have expressed an interest in this symposium that insures its educational value.

The symposium on graduate training for surgery will be devoted to a discussion in which representatives of several interested organizations will participate. As this subject is closely related to the requirements for fellowship in the College, the program will be of particular interest to all Fellows. The College has given this subject close

study during the past six years. Many other organizations are interested and it is hoped that this conference will afford an opportunity for the pooling of all available information. Following the pre-entation of papers dealing with various aspects of the subject there will be a general discussion to bring out the viewpoints of the surgeon in the large teaching hospital, the non teaching hospital and the community or rural hospital. Other interested organizations the American Medical Association, the American Board on Surgery, the American Surgical Association and others have been invited to present their viewpoints. Supplementing these discussions, the findings of the 1937 survey of hospitals in the United States and Canada by the American College of Surgeons will be presented.

On Thursday afternoon, under the auspices of the Committee on Industrial Medicine and Traumatic Surgery, the symposium on industrial medicine and traumatic surgery will be confined to subjects that are of special interest to those who practice medical service in industry. Naturally, these subjects will include features that are of paramount interest to all surgeons today because of the important role that the treatment of injuries has assumed as a result of our widespread mechanization and the development of hitherto unknown degrees of force. There is a demand made on the surgical profession to develop and perfect methods of handling the more terrific injuries to all parts of the body. It is expected that in this symposium some of these methods will be presented. Reports will be presented of the year's surveys. The interest of surgeons in industry will be maintained through the following afternoon when the symposium will deal with the diagnosis and treatment of fractures.

On Friday afternoon the Committee on Fractures will present a program that previous experience leads us to believe will be of paramount interest to a large proportion of the Fellows attending the Congress. Leaders in this branch of surgical practice will present methods concerning which all who deal at times with fractures will wish to be familiar.

The subjects of industrial medicine and traumatic surgery, cancer and fractures will also be extensively featured in the extensive scientific exhibits at headquarters and in clinics and demonstrations in the Chicago hospitals.

HOSPITAL CONFERENCE

The twentieth annual hospital standardization conference of the College will be held during the first four days of the Clinical Congress. An inter-

esting program is being prepared consisting of formal addresses, papers, panel discussions and demonstrations. Throughout this program a special effort will be made to cover fully the many pertinent problems related to hospital administration. In brief, the four-day program will be arranged as follows:

Monday—At the opening session of the Congress, beginning at 10 a m., the approved list of hospitals will be officially announced and representatives of various national organizations will discuss various phases of hospital standardization. The afternoon session will be given over to a well arranged panel discussion on medical staff conferences, concluding with a staged demonstration of a model conference.

Tuesday—At the morning session the various special services of the general hospital will be discussed, including dental service, care of psychiatric patients, occupational therapy, physical therapy, cancer clinics, etc. For the afternoon a series of carefully selected and planned practical demonstrations in Chicago hospitals will be arranged, presenting such problems or phases of hospital work as are of greatest interest to the visiting delegates. A special session will be arranged for the evening for the discussion of the public relations problem of hospitals.

Wednesday—In the morning there will be a joint session with the Association of Medical Record Librarians of America for the discussion of medical record problems. In the afternoon visiting delegates will have an opportunity of attending demonstrations in hospital administration in local hospitals or of attending the special conference on graduate training for surgery at headquarters.

Thursday—The morning and afternoon sessions are to be given over to round table conferences for the discussion of sixteen pertinent practical topics of vital interest to all hospital administrators.

ADVANCE REGISTRATION

The hospitals and medical schools of Chicago afford accommodations for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance.

A registration fee of \$5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card, which is non transferable, must be presented in order to secure clinic tickets and admission to the evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, such plan providing an efficient means for the distribution of the visiting surgeons among the several clinics and insuring against overcrowding, as the number of tickets issued for any clinic will be limited to the capacity of the room in which that clinic is given.

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Convocation—Monday, 8 00 P M —Ballroom Stevens Hotel

Address of Welcome VERNON C DAVID M D, Chicago, Chairman Committee on Arrangements
 Introduction of Foreign Guests
 Address of the Retiring President EUGENE H POOL, M D, New York
 Inauguration of Officers
 Conferring of Fellowships FREDERIC A BESLEY, M D, Waukegan Illinois
 Conferring of Honorary Fellowships The President
 Annual Oration on Surgery J P LOCKHART MUMMERY, M B B Ch F R C S London

Tuesday, Wednesday and Thursday 8 00 P M —Ballroom, Stevens Hotel

Nucleus Pulposus and Lower Back and Sciatic Pains HOWARD C NAYFZIGER M D San Francisco
 Symposium on Lymphedema

The Genesis and Consequences of Lymphedema CECIL K DRINKER M D, Boston

Circulatory and Lymphatic Disturbances in the Abdomen WILLIS D GATCH M D Indianapolis

Diverticula of the Intestine CLAUDE F DIXON, M D Rochester, Minnesota

Immediate or Delayed Treatment of Acute Cholecystitis (Liver Shock and Death) HENRY W CAVE
 M D New York

Tuberculosis of the Kidney FRANK HINMAN M D San Francisco

Physiological and Pathological Changes in the Urinary Tract during Pregnancy J MASON HUNDLEY JR
 M D, Baltimore

Acute Pancreatitis IRVIN ABELL, M D, Louisville

Fracture Oration

Community Health Meeting—Friday 8 00 P M —Ballroom Stevens Hotel

Detailed program in preparation

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL—Charles J. Drueck, Sr., George L. Brooks, Otto Saphir and George Landau Symposium Carcinoma of the rectum carcinoma of the colon

Charles E. Kahlke, George L. Brooks, Otto Saphir and George Landau Symposium Peptic ulcer

COOK COUNTY HOSPITAL—Sumner L. Koch Surgery of the hand

PASSAVANT MEMORIAL HOSPITAL—Sumner L. Koch Michael L. Mason and Harvey S. Allen Surgery of the hand Dupuytren's contracture Von Volkman's contracture, nerve and tendon suture, burn contractures of the hand and plastic repair with skin grafts chronic tenosynovitis

ST ANTHONY DE PADUA HOSPITAL—R. C. Drury Spinal anesthesia

WOMEN AND CHILDREN'S HOSPITAL—Clementine Frankowski and Helen M. Kostka Varicose veins, treatment by injection and by ligation

Tuesday Morning

AUGUSTANA HOSPITAL—A. M. Percv Operations

ALBERT MERRITT BILLINGS HOSPITAL—Clinical demonstrations

Lester R. Dragstedt and staff Clinical and experimental studies in gastric and duodenal ulcer

Walter L. Palmer, F. E. Templeton and Rudolf Schindler X-ray and gastroscopic studies of gastric ulcer under medical treatment

A. Brunschwig Pancreatoduodenectomy for carcinoma of the head of the pancreas

H. P. Jenkins Abdominal wound disruptions and the durability of catgut sutures

CHICAGO MEMORIAL HOSPITAL—Charles E. Kahlke Stomach surgery

Charles J. Drueck, Sr. Surgery of the colon and rectum

COOK COUNTY HOSPITAL—Karl A. Meyer, R. H. Jaffe, M. J. Hubeny, Aaron Arkin and Rudolf Schindler Symposium Surgery of the stomach Operations

Dr. Gatewood Children's surgery

George G. Davis, Albert H. Montgomery, John Harger, Harry Jackson and John G. Frost Operations

GARFIELD PARK HOSPITAL—Edmund Foley, Paul Schmitt Harold Wait Samuel Plize, Claude Weldy and Fred DeStefano Symposium Gall bladder disease

JACKSON PARK HOSPITAL—Staff Symposium Appendicitis

A. Bamberger Surgical aspect

R. R. Jamieson Medical aspect

J. J. Moore Pathological aspect

G. M. Lucas Clinic

W. Morley Sherin Gall bladder surgery

LUTHERAN DEACONESS HOSPITAL—John D. Koucky, G. H. Mammen and George H. Schroeder Operations

MERCY HOSPITAL—Staff Dry clinic

C. F. Sawyer and associates Unusual causes of intestinal obstruction, partial and complete gastrectomy

M. McGuire and associates Pelvic appendicitis, obstructive jaundice

PRESBYTERIAN HOSPITAL—Kellogg Speed, Albert H. Montgomery, Dr. Gatewood and associates Operations

I. C. Doris, C. B. Davis and E. M. Miller Dry clinics and symposia

RAVENSWOOD HOSPITAL—Dry clinic

P. J. Surma Varicose veins, ligation and obliterative treatment

R. E. Dyer End results of gastro enterostomies, demonstration of cases

D. B. Pond and R. F. Greening Treatment of osteomyelitis

J. J. Moore Tumors of breast

D. L. Jenkinson X-ray interpretations

George deTarnowsky Lixtophy of bladder

C. J. Geiger Lixtophy of ureter and absence of vagina, cervical carcinomas

M. H. Field Obstetric practice by general practitioner

W. F. Grosvenor Toxemia in pregnancy

W. C. Hammond Endometriosis

MICHAEL REESE HOSPITAL—D. C. Straus Thyroid operations

Ralph B. Beltman and William Tannenbaum Gall bladder surgery

A. A. Strauss Gastro intestinal surgery

James Patejdl Operations

P. Shapiro Operations

Staff Symposium Gastro intestinal diseases

A. A. Strauss Surgical treatment of peptic ulcer

S. Strauss Pre and postoperative care of the ulcer patient

James Patejdl Perforating ulcer, surgical treatment

Jacob Meyer Medical care of the ulcer patient

Staff Symposium Carcinoma of the rectum

A. A. Strauss Surgical

S. Strauss Surgical diathermy, after care and results of surgical diathermy

M. Appel Histocytic variation in cancer tissue

Gustav Kolisher History of surgical diathermy

Otto Saphir Pathology of the rectum following surgical diathermy

RESEARCH AND EDUCATIONAL HOSPITAL—Géza deTakats Lumbar sympathectomy operation

Staff Symposium Neurocirculatory diseases

R. Brunner The use of neosynephrine in spinal anesthesia

Paul H. Smith Mechanisms governing peripheral circulation

William C. Beck Selection of cases for sympathectomy, demonstration of sympathectomized patients, evaluation of results, management of lymphedema

F. A. Hick Vascular accidents associated with coronary occlusion

H. C. Lueth Unusual reactions following the use of nitroglycerine

Géza deTakats Treatment of acute arterial occlusion, operability of hypertension, demonstration of cases

Eunice Roth Observations on and results of suction and pressure (pneumax therapy)

- P J Sarma and H L Mushkin* The treatment of varicose veins and ulcers
J T Reynolds Amputations in peripheral vascular disease
ST. ANTHONY DE PADUA HOSPITAL—*Joseph Zabokritsky* Operations.
WASHINGTON BOULEVARD HOSPITAL—*Arthur R. Met* General surgery and fractures
WESLEY MEMORIAL HOSPITAL—*R W McVeale* Emory *Strawser* and *F L Bussey* Gastric surgery

Tuesday Afternoon

- CHICAGO MEMORIAL HOSPITAL**—*Bennett R Parker* Thyroid surgery
COOK COUNTY HOSPITAL—*Edward J Lewis* Operations
JACKSON PARK HOSPITAL—*Harry E L Timm* Operations
MERCY HOSPITAL—*C L Martin* Symposium Rectal neoplasms and inflammations
J E Kelley The hernia problem
PASSAUNT MEMORIAL HOSPITAL—*J R Buchbinder* *A C Ivy* and *Arthur B. Field* Symposium on the biliary tract
MICHAEL REESE HOSPITAL—Dry clinic
Valban (Cohn) The use and abuse of the injection treatment of hernia suitable and unsuitable cases methods
Leo Zimmerman Surgical treatment of direct inguinal hernia
Rudolf Schindler The use of the gastroscope and its value to the surgeon
Samuel Goldberg Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections
James Patzold Congenital duodenal obstruction in newborn duodenal diverticuli causing clinical symptoms
Staff Dry clinic
Leo Zimmerman Diseases of veins
Philip Shapiro Recent advances in the treatment of varicose veins
Bernard Portis Embolism of the peripheral arteries
Samuel Perlow Surgical measures used in the treatment of peripheral circulatory disturbances differentiation between arterial and arteriolar patency as an aid in the selection of cases for sympathetic ganglionectomy

- ST. LUKE'S HOSPITAL**—*Geza deTakats* *George Soupham* *George K. Fern* *Carl Johnson* and *Richard Capps* Surgery of cardiovascular diseases
WOMEN AND CHILDREN'S HOSPITAL—Dry clinic Management of diseases complicating surgery
Carolyn MacDonald Syphilis
Rose Menendian Endocrine disorders
Ruth Renter Darrow Diabetes

Wednesday Morning

- ALGUSTANA HOSPITAL**—*A T Lundgren* *Earl Gornide* *R J E Oden* and *J H Yunum* Operations
CHICAGO MEMORIAL HOSPITAL—*Peter S Clark* *Vance Razon* *George Landau* and *Otto Saphir* Gall bladder symposium.
Leo M Zimmerman and *Richard E Heller* Fundamental problems in the surgical treatment of inguinal hernia modern management of varicose veins
CHILDREN'S MEMORIAL HOSPITAL—*H Montgomery J Ireland*, *J Graham W Potts* *I Duggs* and *J Mussel* Operations and demonstration of cases

- COLUMBUS HOSPITAL**—*D A Orin* and *E Vera* Bone and joint tubercle in peritonitis Rollier treatment.
COOK COUNTY HOSPITAL—*Raymond H McVeale* *Manuel Lichtenstein* *Frederick Tice* *Richard H Ja* and *M J Hubert* Symposium Diseases of the gall bladder
Raymond W McVeale *Victor Schrager* *George L Affelbach* *Roger T Vaughan* and *Marshall Dawson* Operations
EVANSTON HOSPITAL—Symposium Colon surgery
L D Snorf Diagnosis
E R Crozier Roentgenology
E L Benjamin Pathology
Frederick Christopher Surgery
W R Parkes Prognosis in malignancy
Staff Dry clinic
Marcus Hobart Operative treatment of low back pain
James Grier Common bile duct obstructions
W A Jennings Prevention of recurrence in femoral hernia operations
JACKSON PARK HOSPITAL—*Arrie Bamberger* Pre and postoperative treatment of uterine cases
C C Clark and *H Boylston* Operations.
LUTHERAN DEACONESSE HOSPITAL—*George O Solem* Surgical indications in peptic ulcer
MUNICIPAL TUBERCULOSIS SANITARIUM—*Clement L Martin* Anorectal tuberculosis
Max Thorek Surgery in tuberculous patient.
PRESBYTERIAN HOSPITAL—*I C David* *Kellie Speed* *C B Davis* *Dr G. C. and E M Miller* *A H Montgomery* and associates Operations
MICHAEL PEELE HOSPITAL—*M L Parker* *Leo Zimmerman* and *Samuel Goldberg* Operations
B Portis Thyroid surgery
Samuel Perlow Peripheral vascular surgery
A A Strauss *S Strauss* and *J Patzold* Gastrointestinal surgery
Ralph B Bettman and *William Tarnenbaum* Gall bladder operations
Staff Dry clinic Surgery of the gall bladder
Samuel Soskin The preparation of the liver for surgery
R A Jrens The technique of cholecystography
I M Serby *S P. J.* and *G L Henstern* The evaluation of liver function test gall bladder diet curves of postoperative results of the gall bladder group
Ralph B Bettman *Leo Zimmerman* and *William Tarnenbaum* Motion picture and diagrammatic demonstration The technique of cholecystectomy choledochostomy choledochostomy or enterostomy
RESEARCH AND EDUCATIONAL HOSPITAL—*H H Cole* Thyroidectomy operation for pyloric obstruction
Staff Dry clinic Symposium Diseases of the thyroid.
H H Cole Pre-operative and postoperative complications
L Seed and *R Brunner* Blood pressure studies during thyroidectomy
J M Mora Hepatic damage in hyperthyroidism
R H Keen Cardiac complications of hyperthyroidism
H H Cole Tracheal collapse
John Howe The thyroid gland as observed at autopsy in patients with diseases other than hyperthyroidism
J H Bailey Bacteriological studies in the operating room
P J Sarma and *H L Mushkin* Clinic on varicose veins

ST ANTHONY DE PADUA HOSPITAL—S E Donlon and H P Salter Operations and demonstration of cases

ST LUKE'S HOSPITAL—H E Jones, Will Lyon, William R Cubbins and associates Operations

U S MARINE HOSPITAL—O E Audeau Results in hernia surgery
E C Lutton and R H Flynn Spinal anesthesia demonstration

WESLEY MEMORIAL HOSPITAL—William Miller Review of gall bladder surgery

FRANCES E WILLARD HOSPITAL—Victor L Schrager Clinic

WOMEN AND CHILDREN'S HOSPITAL—Pearl M Steller Abdominal surgery

Wednesday Afternoon

COLUMBUS HOSPITAL—D A Orth, J L Sprack, C J Scherbel and E D Aora Experimental thyrotoxicosis

MICHAEL REESE HOSPITAL—Staff Symposium
Samuel Perlow Patavertebral alcohol injections for the relief of cardiac pain

Leo Zimmerman and Otto Saphir Benign tumors of the thyroid gland

Samuel Goldberg Acute mesenteric lymphadenitis strangulated hernias in premature infants

Thomas J Merar Rectal complications of lympho granuloma inguinale

Casper Epstein Fractures of the jaws
M L Parker Carcinoma of the large bowel

ST LUKE'S HOSPITAL—S H McArthur and associates Bile tract and colon surgery

WESLEY MEMORIAL HOSPITAL—Guy S Lian Hastyne Abdominal surgery

FRANCES E WILLARD HOSPITAL—Louis F Plak Clinic

Thursday Morning

ACQUSTANA HOSPITAL—V M Percy Operations

CHICAGO MEMORIAL HOSPITAL—Peter S Clark, Leo M Zimmerman and W L Weinstein Gall bladder surgery

COOK COUNTY HOSPITAL—Richard H Jaffe Pathological conference
Karl A Meyer, George G Davis, Albert H Montgomery and Max Thorek Operations

JACKSON PARK HOSPITAL—George M Lucas Operations

LUTHERAN DEACONESS HOSPITAL—John D Koucky, G H Mammen and George H Schroeder Operations

MERCY HOSPITAL—L D Moorhead Symposium Goiter Diseases of the endocrine glands

PASSAWY MEMORIAL HOSPITAL—Paul Starr Symposium Diseases of the endocrine glands

PRESBYTERIAN HOSPITAL—I C David, C B Davis, William Miller and associates Operations

Kellogg Speed, Dr Gatewood and I B Montgomery Dry clinics and symposia

MICHAEL REESE HOSPITAL—1 I Strauss and S Strauss Gastro-intestinal surgery

D C Straus General surgery
Staff Thyroid symposium

D C Straus Group study and demonstration of thyroid records surgical management of hyperthyroidism

S Soskin The endocrine disturbance in thyroid disease

L V Aat Disturbed physiology of the cardiovascular system in thyroid disease

M Le Some clinical aspects of the heart in hyperthyroidism, medical management of hyperthyroidism

A S Bohning and L V Katz The electrocardiogram in thyroid disease

W H Hamburger Arrhythmias in thyroid disease

B Portis Outpatient clinic management of hyperthyroidism

B Portis and H Roth Treatment of hyperthyroidism complicated by pregnancy and syphilis

R Levine Experimental treatment of hyperthyroidism

RESEARCH AND EDUCATIONAL HOSPITAL—C B Puestow Operations Cholecholestomy, carcinoma of rectum

Staff Symposium Gall bladder diseases

C B Puestow The effect of cholecystectomy on pressure in the choledochus, gall bladder fistula

Edmund Foley Differential diagnosis between intrahepatic and extrahepatic jaundice

W H Cole The role of cystic duct obstruction to gall bladder disease

A Hartung The advantage of combining gastro intestinal series with cholecystography

ST ANTHONY DE PADUA HOSPITAL—F B Orlentine Operations and demonstration of goiter and abdominal surgery cases

WESLEY MEMORIAL HOSPITAL—R H McLaughlin and associates Surgery of jaundiced patients

FRANCES E WILLARD HOSPITAL—A E Stewart Clinic

WOMEN AND CHILDREN'S HOSPITAL—Pearl M Steller and Marie Ortmayer Gastro intestinal clinic, gastroscopic technique

Alice Conklin Thyroidectomy
Esther Kahn Repair of ventral hernia

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL—Bennett R Parker, Leo M Zimmerman, Walter S Priest, Otto Saphir and George M Landau Symposium Thyroid disease

Frank Wright, Albert Zrunek, Leo M Zimmerman, W L Weinstein and Otto Saphir Symposium Blood transfusion

COOK COUNTY HOSPITAL—Ralph B Beltman and Edward J Lewis Operations

MICHAEL REESE HOSPITAL—Symposium Gastro intestinal surgery

Leon Bloch The medical treatment of ulcerative colitis

A I Strauss The surgical management of ulcerative colitis

S Strauss The use of ileostomy in ulcerative colitis and carcinoma of the colon

Otto Saphir Pathology of ulcerative colitis Discussion

R Irens X ray diagnosis of ulcerative colitis and peptic ulcer Discussion

A I Strauss and H F Binswanger Medical and surgical treatment of terminal ileitis

RESEARCH AND EDUCATIONAL HOSPITAL—Symposium Diseases of the gastro intestinal tract

George Miles and W H Cole Pathology of carcinoma of stomach total gastrectomy

C L Birch Anemia associated with total gastrectomy

M H Strecher Diagnosis of carcinoma of the rectum

C B Puestow Surgical treatment of carcinoma of the rectum

Bernard Portis Surgical treatment of complicated duodenal ulcers

- F L McMillan* Regional ileitis
J L Spiack Tuboovular stoma with particular reference to gastrostomy
H O Wernicke The injection treatment of hernia
ST. ANTHONY DE PADUA HOSPITAL—*H H Bradley* Operations
WESLEY MEMORIAL HOSPITAL—*E B Perry* and *H E L Barnard* Abdominal surgery
FRANCIS E. WILLARD HOSPITAL—*Olis M Walter* Clinic
WOMEN AND CHILDREN'S HOSPITAL—*Emelia Girjotas* Cholecystectomies

Friday Morning

- ALBERT MERRITT BILLINGS HOSPITAL**—Presentation on surgery and the circulation
H Livingston Anesthesia and the circulation
A Roome, H Wilson H A Harkins and *D B Phenister* Studies in causes and treatment of surgical shock
H E Adams Intrathoracic operation and the circulation
COLUMBUS HOSPITAL—*M J Seifert* Gastro intestinal surgery
COOK COUNTY HOSPITAL—*Dr Gatewood* Children's surgery
Ralph C Sullivan *Vernon C David* *Harry Jackson* and *Frank J Jurka* Operations
JACKSON PARK HOSPITAL—*Arrie Bamberger H Hoyt Cox* and *C Clark* Operations
LUTHERAN DEACONESS HOSPITAL—*John D Koucky G H Mammen* and *George H Schroeder* Operations
George O Solem Surgical indications in peptic ulcer
PASSAVENT MEMORIAL HOSPITAL—*Samuel J Fogelson* Experimental surgical problems
PRESBYTERIAN HOSPITAL—*V C David Kellogg Spred C B Davis Dr Gatewood William Miller* and *A H Montgomery* Operations
MICHAEL REESE HOSPITAL—*J Palejdl P Shapiro R Crauford B Portis S Goldberg M L Parker* and *Leo Zimmerman* Operations

Monday Afternoon

- RESEARCH AND EDUCATIONAL HOSPITAL**—*H B Thomas F W Mark* and *C V Lambert* Symposium Tenodesis Operations and demonstration of cases shelving of congenital dislocated hip demonstration of patients with closed reduction open reduction and shelving of congenital dislocation

Tuesday Morning

- CHILDREN'S MEMORIAL HOSPITAL**—*F Chandler F Sedler C Pease* and *J Vorcross* Operations and demonstration of cases
COOK COUNTY HOSPITAL—*Arthur Conley* Operations and symposium with demonstration of cases blind pegging of hip for fracture of neck of femur using Kirschner wire and Smith Petersen nail, problems in diagnosis of bone tumors, painful back in medicolegal cases persistent dizziness following head injuries fractures in and about the ankle
Marcus H Hobart Operations removal of internal semilunar cartilage Demonstration of cases recurrent dislocations of the shoulder, internal derangement

- RESEARCH AND EDUCATIONAL HOSPITAL**—*R B Malcolm* Operative clinic Neck dissection carcinoma of breast surgical pathology of breast tumors
Stiff Dry clinic
T J Wachowski X ray treatment of carcinoma of the breast
Arrie Bamberger Ewing tumor with case report
S R Rosenthal The toxin and antitoxin of burns
C H Puestow Vitamin ointments in the healing of burns
B H Cole Acute pancreatitis

- ST. ANTHONY DE PADUA HOSPITAL**—*J J Sprafkin* Abdominal surgery and demonstration of cases
ST. ELIZABETH'S HOSPITAL—*E D Kolodge* Thyroid disease
ST. LUKE'S HOSPITAL—*E W Hirsch E Jenkinson* and staff members. Staff clinic
WESLEY MEMORIAL HOSPITAL—*Earl Latimer* Unusual breast tumors

Friday Afternoon

- COOK COUNTY HOSPITAL**—*J G Frost* Operations
Sumner L Koch Surgery of the hand
E H Warschski Operations
JACKSON PARK HOSPITAL—*Harry E L Timm* Operations
ST. ELIZABETH'S HOSPITAL—*J A Varat* Pre and post operative intravenous administration of fat emulsion

Days to be Announced

- COOK COUNTY HOSPITAL**—*Victor L Schrag* Symposium
 Appendicitis
Sumner L Koch Symposium Hand infections
Harry Jackson Symposium Skull fractures
Edwin M Miller Symposium Children's surgery
Frederick G Dyas Symposium Penitonsitis
Marshall Dawson Symposium Diseases of the thyroid gland
Vernon C David Symposium Surgery of the large bowel
HENROTIN HOSPITAL—*John I Graham* Demonstration clinic
Karl I Meyer and *Peter Ross* Dry clinic

ORTHOPEDIC SURGERY

of the knee joint spinal fusions and low back pain acquired dislocations of the hip following scarlet fever, syndactylism

- PRESBYTERIAN HOSPITAL**—*E J Berkeiser* Dry clinic and demonstration of cases
MICHAEL REESE HOSPITAL—*Philip Levan Daniel Lenthall Charles Pease F Glassman Sidney Sideman Jerome G Finder* and *I Wolin* Operations

Tuesday Afternoon

- WESLEY MEMORIAL HOSPITAL**—*F M Janney H Kelikson* and *O H Norrall* Bone and joint surgery

Wednesday Morning

- LUTHERAN DEACONESS HOSPITAL**—*Emil Vrihak* Indications for surgical treatment of arthritis
MUNICIPAL TUBERCULOSIS SANITARIUM—*E. J Berkeiser* Bone tuberculosis
VETERAN'S ADMINISTRATION FACILITY—*S K Livingston* Operations
WESLEY MEMORIAL HOSPITAL—*Philip H Kreuscher* and associates Bone and joint surgery knee injuries

Wednesday Afternoon

- EVANSTON HOSPITAL—J L Porter and R C Lonergan
Low back disorders
- MERCY HOSPITAL—J D Claridge and associates
Problems in orthopedic and traumatic surgery
- PRESBYTERIAN HOSPITAL—E J Berkheiser, Kellogg Speed
and D Rider Operations
- MICHAEL REESE HOSPITAL—Philip Lewin
Fracture problems, new approach for arthrodesis of knee joint, discussion of bone tumors, motion picture demonstration of manipulative surgery

Sidney Sideman
Rice bodies in tendon sheath of the hand, Hoke stabilization of the foot, spastic paralysis, roentgenologic library of the hip joint, fusion operation in tuberculosis of the knee joint, bunion operation, multiple cartilaginous exostosis

Daniel H Levinthal and Irving Wolin
Tendon transplantation in poliomyelitis, spastic paralysis, recurrent dislocation of shoulder flat feet demonstration of arthroplasties of the knee, hip and elbow knee joint surgery

Charles Pease
Acute transverse atrophy of bone traumatic rupture of intervertebral disc reduction of compression fracture of spine, osteochondromatosis of the elbows

Jerome G Funder
Chondromyxosarcoma two cases
Exostosis of the thumb for paralytic opposition pollicis osteochondroma of the tibia McBurney bunion plasty unusual bone tumor () of femur Key operation for soft corns spastic paralysis—bilateral adductor tenotomy and obturator nerve neurectomy, case with unusual deformities

Frank Gilman
Fracture and dislocation of shoulder-suprascapular fracture of the humerus fracture of the neck of the femur, complete fracture of the tibia and fibula removal of the head of the radius three cases osteoma of the femur demonstration of various types of fractures and treatment

St. ANTHONY DE PADUA HOSPITAL—Thomas Dwyer
New bone biopsy technique pathological specimens

VETERANS ADMINISTRATION FACILITY—S F Livingston
Bone tumors

Thursday Morning

ALBERT MERRITT BUILDERS HOSPITAL—Presentation on bone and joint surgery

E L Campbell
Leg lengthening operation technique and results spinal fusion in the correction of scoliosis

C E Fraser
The pathology and treatment of tuberculous arthritis studies in the role of skeletal growth and replacement of limb length

FRACTURES AND TRAUMATIC SURGERY

Monday Afternoon

CORRIGAN HOSPITAL—William R. Cahill and associates
Operative fractures

JACKSON PARK HOSPITAL—S F M. Rose and C W. Brown and M J. McLean
Traumatic surgery

St. ANTHONY DE PADUA HOSPITAL—F W. Shobe
Fractures special phases of traumatic surgery

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL—Arthur E. Conley and S. Perry Ross
Symposium: Blind pegging of fractures of the skull

H N Harkins
Bone graft operations for ununited fracture

P C Bury and R B Cloward
Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis

C B Huggins
Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton

COOK COUNTY HOSPITAL—Daniel H Levinthal
Bone graft surgery for nonunion, stabilization and benign bone tumors Motion picture demonstration Surgical treatment of spastic paralysis, surgical treatment of residual paralysis following poliomyelitis

Philip H Kerschner
Nicola operation, scullular cartilage derangement, spinal grafts, new operation for hip fusion, new operation for knee fusion

Philip Lewin
Tunnel skin graft over a calcaneal spur, talipes, stabilization of paralytic varus foot, arthrodesis of ankle joint, hallux varus, tuberculous spine, fusion, infantile paralysis, low back pain with "sciatica"

Frank G Murphy
Skin grafts for old wounds of leg, unusual bone tumors, fracture into ankle joint, malunion of Colles' fracture, tuberculosis of humeral head, bone, near contracture of forearm, skin graft

MICHAEL REESE HOSPITAL—Philip Lewin, Daniel Levinthal, Charles Pease, J. Glanville, J. Wolin, Sidney Sideman and Jerome G Funder
Operations

VETERANS ADMINISTRATION FACILITY—S F Livingston
Maggot treatment of osteomyelitis

Thursday Afternoon

COOK COUNTY HOSPITAL—J J Perthes and associates
Operations and demonstration of cases—spinal tuberculosis, anterior poliomyelitis, arthrodesis and tendon transplantation

PRESBYTERIAN HOSPITAL—J J Perthes and D. Fisher
Operations

RESEARCH AND EDUCATIONAL HOSPITAL—H B Thomas, F W Harkins and C V Lambert
Operation: Stelling of a congenital dislocated hip Demonstration of patients with closed reduction, open reduction, and stelling of congenital dislocation

St. LUKE'S HOSPITAL—J B. Pyron and associates
Demonstration of cases

Friday Morning

UPPER MERIDIAN HOSPITAL—Paul V. Harkins
Indications for surgical treatment of arthritis

PRESBYTERIAN HOSPITAL—E J Berkheiser, Kellogg Speed and D Rider
Operations

Fred Miller, T C Brown, Jr., Emily Dwyer and George M. London
Fracture of both bones of lower leg

COOK COUNTY HOSPITAL—William P. Caffery and associates
Ward walk

WASHINGTON BORLEYARD HOSPITAL—Arthur R. Metz
General surgery and fractures

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL—C R G. Fortney, Harry S. Ross and J H. Nelson
Symposium: Fractures; nerve repair

COOK COUNTY HOSPITAL—Samuel L. Kirk and associates
Tendon and nerve suturing of the hand, hand infections

EVANSTON HOSPITAL—*J I Farrell* Undescended testicles
ST ELIZABETH'S HOSPITAL—*T G McDougall* Carcinoma of the bladder

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL—*Herman L Kretschmer* and *A Barber* Operations and demonstration of cases
COOK COUNTY HOSPITAL—*Harry Culver* and *Charles McKenna* Symposium Chronic bladder neck obstructions in the male
JACKSON PARK HOSPITAL—*William I onker* Transurethral prostatic resection compared to other types of prostatic surgery
PRESBYTERIAN HOSPITAL—*Herman L Kretschmer, Robert Herbst* and associates Operations
MICHAEL REESE HOSPITAL—*I Koll, J Esenstaedt II Rolnick I Shapiro, J Grove, F Lieberthal* and *A L Jones* Operations

ST LUKE'S HOSPITAL—*L W Schmidt* and associates Dry clinic

VETERANS ADMINISTRATION FACILITY—*T G McDougall* Carcinoma of the bladder

WESLEY MEMORIAL HOSPITAL—*V D Lespinasse* and associates Clinic

Friday Morning

PRESBYTERIAN HOSPITAL—*Herman L Kretschmer, Robert Herbst* and associates Dry clinic
VETERANS ADMINISTRATION FACILITY—*T G McDougall* Perineal prostatectomy

Days to be Announced

COOK COUNTY HOSPITAL—*L L Vessen* and *Harry Rolnick* Symposium Pyogenic infections of the upper urinary tract
HENROTIN HOSPITAL—*Dorrie Kidnick* Kidney complications in women

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL—*H C Voris* and *J J Kearns* Intracranial injury—demonstration of pathology physiology, management, surgical interference, sequelae complications

Tuesday Morning

RESEARCH AND EDUCATIONAL HOSPITAL—*Gesa deTakats* Operation Lumbar sympathectomy
Staff Symposium Neurocirculatory diseases
R Brunner The use of neosynephrine in spinal anesthesia
Paul H Smith Mechanisms governing peripheral circulation
William C Beck Selection of cases for sympathectomy, demonstration of sympathectomized patients evaluation of results the management of lymphedema
F A Hick Vascular accidents associated with coronary occlusion
H C Luthi Unusual reactions following the use of nitroglycerine
Gesa deTakats The treatment of acute arterial occlusion operability of hypertension, demonstration of cases
Emmace Roth Observations on and results of suction and pressure (pavac) therapy
H L Mishkin and *P J Sarma* The treatment of varicose veins and ulcers
J T Reynolds Amputations in peripheral vascular disease

Tuesday Afternoon

MERCY HOSPITAL—*C F Schaub* and *H C Voris* Neuro ophthalmology Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions
PRESBYTERIAN HOSPITAL—*A Verbrugghen* Dry clinic and demonstration

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITAL—*Eric Oldberg* Operations and demonstration of cases

Wednesday Afternoon

COOK COUNTY HOSPITAL—*A Verbrugghen* Surgical paraplegia—etiology pathology, classification, physiology, treatment prognosis
PRESBYTERIAN HOSPITAL—*A Verbrugghen* Operations

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL—*P C Bucy* and *R B Cloward* Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis
RESEARCH AND EDUCATIONAL HOSPITAL—*Eric Oldberg* Operations and demonstration of cases

Thursday Afternoon

MERCY HOSPITAL—*H C Voris* and associates Symposium Management of cerebral gliomas
H C Voris and *H E Landes* Demonstration of choroid plexus resection in hydrocephalus, cytometric studies in neurological lesions
C F Schaub and *H C Voris* Neuro ophthalmology Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions
PRESBYTERIAN HOSPITAL—*A Verbrugghen* Operations
MICHAEL REESE HOSPITAL—*Staff* Symposium Intracranial suppuration
Roy Grinker Neurological aspects of intracranial suppuration
A Verbrugghen Surgical aspects of brain abscess

Friday Afternoon

PASSAUNT MEMORIAL HOSPITAL—*Loyal Davis* and *John Martin* Neurological surgery Presentation emphasizing diagnosis and treatment
PRESBYTERIAN HOSPITAL—*A Verbrugghen* Operations

THORACIC SURGERY

Monday Afternoon

ST LUKE'S HOSPITAL—Willard Van Hael Demonstration clinic
Paul H Holinger Surgery of bronchus

Tuesday Morning

COLUMBUS HOSPITAL—R M Dawson C Volins M Joannides D Orth and G Mueller Symposium in tuberculosis Thoracic surgery pneumothorax treatment including climatotherapy

COOK COUNTY HOSPITAL—John B O Donoghue and Robert Lee Treatment of empyema ward walk and presentation of cases

RESEARCH AND EDUCATIONAL HOSPITAL—Willard Van Hael Operations with demonstration of cases

VETERANS ADMINISTRATION FACILITY—Jerome R Head New type of thoracoplasty chest surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL—Ralph B Bettman Operations
PRESBYTERIAN HOSPITAL—John Dorsey Dry clinic and demonstration

RESEARCH AND EDUCATIONAL HOSPITAL—Willard Van Hael and staff Symposium Bronchogenic carcinoma S Levinson Pathology

Adolph Hartung Roentgenological diagnosis

Paul H Holinger Bronchogenic aspects

Willard Van Hael Surgical consideration demonstration of cases and specimens surgical treatment of mediastinal tumors

M Joannides Collapse therapy of pulmonary tuberculosis

T J Wachowski Roentgenological consideration of mediastinal tumors

Wednesday Morning

EVANSTON HOSPITAL—Jerome R Head Indications for lobectomy

MUNICIPAL TUBERCULOSIS SANITARIUM—Richard Dawson Thoracoplasty

Wednesday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM—M Joannides Phrenic surgery intrapleural pneumolysis

PRESBYTERIAN HOSPITAL—John Dorsey Operations

Thursday Morning

MUNICIPAL TUBERCULOSIS SANITARIUM—Richard Dawson Thoracoplasty pneumolysis

Thursday Afternoon

COOK COUNTY HOSPITAL—Ralph B Bettman Operations

PRESBYTERIAN HOSPITAL—John Dorsey Operations

MICHAEL REESE HOSPITAL—Ralph B Bettman and William Tannenbaum Thoracic surgery

Friday Morning

MICHAEL REESE HOSPITAL—Ralph B Bettman and William Tannenbaum Thoracoplasty operation
Max Biesenthal Surgery of pulmonary tuberculosis

Max Biesenthal and Ralph B Bettman Technique of various operations used for pulmonary tuberculosis Artificial pneumothorax pneumolysis, thoracoplasty motion picture and diagrammatic demonstrations

Ralph B Bettman Treatment of empyema injuries of the chest presentation of cases motion picture and diagrammatic demonstrations

WOMEN AND CHILDREN'S HOSPITAL—Helen Hayden Emelia Girvelas Margaret Austin and Nora B Brundenburg Bronchoscopy in relation to asthma and allied pulmonary conditions lipiodol injection

Friday Afternoon

COOK COUNTY HOSPITAL—John B O Donoghue Frederick Tice Richard Jaffe M J Hubeny S H Rosenblum and A J Hruby Symposium Pulmonary tuberculosis

John B O Donoghue Operations

PRESBYTERIAN HOSPITAL—John Dorsey Operations

GYNECOLOGY

Monday Afternoon

COOK COUNTY HOSPITAL—Frederick H Falls Operations
WOMEN AND CHILDREN'S HOSPITAL—Annie E Blount Operations

Tuesday Morning

COOK COUNTY HOSPITAL—Carey Culbertson and A E Kanter Operations

PRESBYTERIAN HOSPITAL—V S Heaney Carey Culbertson A E Kanter E D Allen and H Boysen Operations

MICHAEL REESE HOSPITAL—J L Baer J E Lackner William Rubowitz I F Stern and Ralph Reis Operations

ST LUKE'S HOSPITAL—H O Jones and associates Clinic

WESLEY MEMORIAL HOSPITAL—Mark Goldstone and associates Uterine bleeding

WOMEN AND CHILDREN'S HOSPITAL—Mary Edith Williams Removal of abdominal and pelvic tumors

Otilie Zeleny Electrocoagulation of the cervix uteri

Tuesday Afternoon

COOK COUNTY HOSPITAL—J P Greenhill Operations

WOMEN AND CHILDREN'S HOSPITAL—Eloise Parsons Vaginal hysterectomy vaginal sterilization ligation of tubes per vaginal route

Wednesday Morning

COOK COUNTY HOSPITAL—C H Burnett Operations

PASSAUNT MEMORIAL HOSPITAL—George Gardner and Arthur H Curtis Gynecological pathology—demonstration and conference

PRESBYTERIAN HOSPITAL—V S Heaney Carey Culbertson A E Kanter E D Allen and H Boysen Demonstration of cases

MICHAEL REESE HOSPITAL—Dry clinic

Joseph L Baer Shilling trends in the treatment of prolapse of the uterus

Julius E Lackner Recent investigations in the action of progesterone

William H Rubovits Postoperative vaginal anti sepsis
 Irving F Stein Evaluation of the "safe period"
 Ralph A Reis Mammography
 Lester F Frankenthal, Jr Treatment of vulvovaginitis
 Michael L Leventhal The Manchester operation for the cure of cystocele and prolapse
 Henry Burbaum The role of spermotoxin in temporary sterility
 A F Lash Early diagnosis of carcinoma of the uterus
 L J DeCosta The use of progesterone in the prevention of habitual abortion
 Alfred J Kobak Maternal mortality in Chicago
 Herman Strauss Routine palpation of the ureters during hysterectomy

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL—Paul M Clier, Julia C Straan, Harry L Meyers, Beatrice E Tucker and Walter Wiborg Plastic repair
 COOK COUNTY HOSPITAL—H T Carlisle Operations
 WOMEN AND CHILDREN'S HOSPITAL—Constance O'Britis Operations

Thursday Morning

CHICAGO MEMORIAL HOSPITAL—Paul M Clier, Julia C Straan, Harry L Meyers, Beatrice E Tucker and Walter Wiborg Symposium The treatment of prolapse of the uterus, cystocele and rectocele at various ages
 COOK COUNTY HOSPITAL—Egon W Fischmann Operations
 PRESBYTERIAN HOSPITAL—A S Heaney, Carey Culbertson, A E Kanter, E D Allen and H Boyesen Operations
 ST ANTHONY DE PADUA HOSPITAL—M A Weisskopf Operation
 WASHINGTON BOULEVARD HOSPITAL—Paul C Fox Operations and demonstration of cases
 WESLEY MEMORIAL HOSPITAL—Mark Goldsline and associates Vaginal plastics

Monday Afternoon

CHICAGO LYING IN HOSPITAL—Fred L Adair and staff Motion picture demonstration of cesarean section
 COOK COUNTY HOSPITAL—A F Lash Puerperal sepsis, ward walk

Tuesday Morning

CHICAGO LYING IN HOSPITAL—Fred L Adair, William J Dieckmann, M Edward Davis, H C Hesselstine and staff Cesarean section Motion picture demonstration of colpocleisis operation
 COOK COUNTY HOSPITAL—D S Hillis Treatment of abortion, ward walk
 FRANCES F WILLARD HOSPITAL—Ascher H Goldfine Clinic

Tuesday Afternoon

CHICAGO LYING IN HOSPITAL—William J Dieckmann and staff Dry clinic Eclampsia Motion picture demonstration of forceps delivery

Thursday Afternoon

COOK COUNTY HOSPITAL—Frederick H Falls Operations

Friday Morning

COOK COUNTY HOSPITAL—A E Kanter and Carey Culbertson Operations
 PRESBYTERIAN HOSPITAL—A S Heaney, Carey Culbertson, A E Kanter, E D Allen and H Boyesen Operations
 MICHAEL REESE HOSPITAL—J I Baer, J E Lackner, William Rubovits, I F Stein and Ralph Reis Operations

Friday Afternoon

COOK COUNTY HOSPITAL—Carey Culbertson Operations
 MERCY HOSPITAL—H E Schmitz and associates Symposium on operative gynecology
 RESEARCH AND EDUCATIONAL HOSPITAL—Symposium Gynecological plastic operations with special reference to the use of local anesthesia
 Frederick H Falls Vaginal hysterectomy for proclidentia under local anesthesia
 M J Summerville Anterior colporrhaphy and interposition operation under local anesthesia
 William H Browne Sturmdorf Kelly incontinence operation and perineorrhaphy under local anesthesia
 WOMEN AND CHILDREN'S HOSPITAL—Catherine True Abdominal gynecological cases
 Eloise Parsons Treatment of sterility, treatment of eroded cervix by cautery, lipiodol visualization of uterus and tubes

Days to be Announced

COOK COUNTY HOSPITAL—J P Greef, J W Barrett, H T Carlisle, Egon W Fischmann, Frederick H Falls, A E Kanter and Carey Culbertson Symposium on fibroids
 HENROTIN HOSPITAL—Edward L Cornell Operations and demonstration of cases
 Channing W Barrett and Lee Stone Operations and demonstration of cases

OBSTETRICS

COOK COUNTY HOSPITAL—L Rudolph and J H Bloomfield Symposium The toxemias of pregnancy
 ST ELIZABETH'S HOSPITAL—J R Laueri Cesarean section
 FRANCES F WILLARD HOSPITAL—Ascher H Goldfine Clinic

Wednesday Morning

CHICAGO LYING IN HOSPITAL—Fred L Adair, William J Dieckmann, M Edward Davis, H C Hesselstine and staff Operations and demonstration of cases
 COOK COUNTY HOSPITAL—J E Fitzgerald Heart disease in pregnancy, ward walk
 JACKSON PARK HOSPITAL—Charles F Greene, Louis H Stern, W J Nixon Davis, Jr and Norman Zolla Treatment of contracted pelvis by cesarean section, version and forceps
 RESEARCH AND EDUCATIONAL HOSPITAL—Symposium Frederick H Falls Eclampsicogenic toxemia, low cervical cesarean section under local anesthesia

H H Broeze Progestin in the treatment of abortion

G H Reek Modulation of the Friedmann reaction

WESLEY MEMORIAL HOSPITAL—*Charles B Reed William B Serbin and G C Richardson* Moving picture demonstration of low forceps, breech extraction with forceps on aftercoming head spontaneous breech—manual aid

WOMEN AND CHILDREN'S HOSPITAL—Dry clinic

Flora E Hark Prenatal care with reference to the baby

Ruth R Darro Treatment of icterus gravidarum

Bertha Van Hoosen Maternity mortality

Wednesday Afternoon

CHICAGO LYING-IN HOSPITAL—*H C Hesselbaine* and staff Nonconvulsive toxemia of pregnancy Motion picture demonstration of birth injury

CHICAGO MEMORIAL HOSPITAL—*James E Fitzgerald William F Herz George V Schiff and Harry Benaron* Cesarean section

COOK COUNTY HOSPITAL—*D S Huls J H Boomfeld and A F Lusk* Symposium Cesarean section

RESEARCH AND EDUCATIONAL HOSPITAL—*Frederick H Fols* and staff Operations. Symposium Gynecological tumors

Frederick H Fols Vulva carcinoma demonstration of cases, vulvectomy under local anesthesia

R A Liferdahl Solid tumors of ovary removal of ovarian cyst

H H Bull Early carcinoma of cervix

WOMEN AND CHILDREN'S HOSPITAL—Dry clinic

Bertha Van Hoosen and Maude Haul Barrett Anesthesia in obstetrics

Beatrice E Tucker Parasacral anesthesia

Thursday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L Adair William J Diekmann M Edward Davis H C Hesselbaine* and staff

Cesarean section. Motion picture demonstration of blood transfusion

CHICAGO MEMORIAL HOSPITAL—*James E Fitzgerald William F Herz George V Schiff and Harry Benaron* Indications and technique for cesarean section nerve block in obstetrics

COOK COUNTY HOSPITAL—*J E Fitzgerald and L Rudolph* Symposium Ectopic pregnancy its diagnosis and treatment

Thursday Afternoon

CHICAGO LYING-IN HOSPITAL—*M Edward Davis* and staff Placenta previa abruptio placenta Motion picture demonstration of postpartum hemorrhage

COOK COUNTY HOSPITAL—*J H Boomfeld and D S Huls* Symposium Late hemorrhages of pregnancy

Friday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L Adair William J Diekmann M Edward Davis H C Hesselbaine* and staff Cesarean section Dry clinic

COOK COUNTY HOSPITAL—*A F Lusk* Toxemia of pregnancy ward walk

WESLEY MEMORIAL HOSPITAL—*Charles B Reed William B Serbin and G C Richardson* Ablatio placenta placenta previa

WOMEN AND CHILDREN'S HOSPITAL—*Bertha Van Hoosen and Maude Haul Barrett* Surgical cases complicating obstetrics

Friday Afternoon

CHICAGO LYING-IN HOSPITAL—*Fred L Adair* and staff Dry clinic Motion picture demonstration of epidural anesthesia

COOK COUNTY HOSPITAL—*L Rudolph* Symposium Prolonged labor contraction ring dystocia

TUMORS AND IRRADIATION

Monday Afternoon

ST ELIZABETH'S HOSPITAL—*J Bruns* Radium treatment of fractures

VETERANS ADMINISTRATION FACILITY—*G R Allen* Regular tumor clinic

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL—*Isadore Pilot* Pathology of malignant growths in relation to therapeutic indications

ST ELIZABETH'S HOSPITAL—*M G Loken* Sarcoma of the stomach

VETERANS ADMINISTRATION FACILITY—*A E Williams* Deep x ray and radium therapy

Tuesday Afternoon

RAVENSWOOD HOSPITAL—*C Bustell J J Moore H P Saunders and L E Schaefer* Cancer clinic presentation of specimens lantern slides, cases illustrating melanomas of shoulder and jaw

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL—Presentation on tumor surgery

A Brunschwig Experimental production of tumors and the efficacy of Coley's toxin in the treatment of

experimental sarcoma palliative treatment of pulmonary metastases from malignant tumors late results in treatment of benign giant-cell tumors of bone

D B Phenister and associates Studies in the etiology diagnosis and treatment of bone tumors

Harwell Wilson Extra-skeletal osseous tumors

VETERANS ADMINISTRATION FACILITY—*Max Cramer* Annual tumor clinic Presentation of cancer cases, indications, technique and results of radium therapy

G R Allen Diagnosis and treatment

Thursday Morning

COLUMBUS HOSPITAL—*D A Orth M Harnett and H E Davis* Symposium Breast cancer

LUTHERAN DEACONESS HOSPITAL—*Isadore Pilot* Pathology of malignant growths in relation to therapeutic indications

MERCY HOSPITAL—*W J Pickett* Unusual cases of malignancy

MICHAEL REESE HOSPITAL—*Max Cramer* and staff Results of radiation treatment of cancer of mouth, tongue, pharynx and larynx presentation of cases Radiation treatment of cancer of the breast presentation of cases Motion pictures illustrating the technique of radium treatment of cancer of the mouth and cancer of the cervix Transillumination of the breast

ST ELIZABETH'S HOSPITAL—*Leo M. Zimmerman* Medi-
astinal tumors

VETERANS ADMINISTRATION FACILITY—*A. E. Williams*
Inspection of deep x ray and radium therapy unit

Thursday Afternoon

PASSAUNT MEMORIAL HOSPITAL—*Mar Cutler* The organ-
ization of a tumor clinic Personnel, equipment,
records, follow up

Staff Carcinoma of the breast

John I. Hoffer Surgical considerations

James T. Case Pre and postoperative x ray radiation

L. M. Rosenthal Radium treatment

Major Greene Bronchogenic tumors of the neck

John F. Delph and Carl Barth Carcinoma of the

larynx, hypopharynx and tonsil

John Mohardt A survey of some proposed cancer cures

Friday Morning

MERCY HOSPITAL—*Henry L. Schmitz* and associates Sym-
posium Radiologic therapy of malignancy

ST LUKE'S HOSPITAL—*H. E. Mock* and associates Tumor
clinic

VETERANS ADMINISTRATION FACILITY—*G. R. Allaben*
Regular tumor clinic

Friday Afternoon

PRESBYTERIAN HOSPITAL—*Carl Affelbach* and *F. Squire*
Dry clinic and demonstration

Day to be Announced

HENROTIN HOSPITAL—*Samuel Levinson* Surgical pathol-
ogy

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL—*Casper M. Epstein* Sym-
posium Plastic, including faciomaxillary surgery

COOK COUNTY HOSPITAL—*Joseph E. Schaefer* Demon-
stration of cases showing corrected temporomandibular
ankylosis, harelips and cleft palates, pedicle flap and full
thickness graft cases, repair of burns traumatic in-
juries, plastic repairs of controlled carcinoma cases

Tuesday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R.*
Olmsted Operations

Wednesday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R.*
Olmsted Operations

Thursday Morning

COOK COUNTY HOSPITAL—*Joseph F. Schaefer* Demon-
stration of cases showing carcinoma of mouth, lips and
face, with colored photographs of lesions before and
after radiation

MICHAEL PELSE HOSPITAL—*Casper Epstein* Oral surgery

Thursday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R.*
Olmsted Dry clinic and demonstration

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL—*L. H. Schultz* Dry
clinic and demonstration

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R.*
Olmsted Operations

ROENTGENOLOGY

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL—*Ralph Hilly* Newer
concepts in the treatment of carcinoma

Tuesday Afternoon

ST ANTHONY DE PADUA HOSPITAL—*L. S. Tichy* Sclerosis
demonstration

ST LUKE'S HOSPITAL—*Staff* X ray diagnosis

Wednesday Afternoon

AUGUSTANA HOSPITAL—*David S. Beilen* Roentgen diag-
nosis of gastro intestinal lesions

ALBERT MERRITT BILLINGS HOSPITAL—*Paul C. Hodges*
and associates X ray diagnosis

Thursday Morning

LUTHERAN DEACONESS HOSPITAL—*Ralph Hilly* Newer
concepts in the treatment of carcinoma

RESEARCH AND EDUCATIONAL HOSPITAL—*Adolph Hartung*
Conference on x ray diagnosis

Thursday Afternoon

COOK COUNTY HOSPITAL—*Robert F. McNaughtin* High
voltage therapy of malignancies

M. J. Hubeny Roentgenological examination of
appendix

ST LUKE'S HOSPITAL—*Staff* X ray diagnosis

Friday Afternoon

AUGUSTANA HOSPITAL—*David S. Beilen* Roentgen diag-
nosis of lesions of urinary tract

COOK COUNTY HOSPITAL—*J. Paul Bennett* Roentgeno-
logical examination of the kidneys, ureters and
bladder

Robert F. McNaughtin High voltage therapy of malig-
nancies

Days to be Announced

HENROTIN HOSPITAL—*Arthur R. Hansen* X ray demon-
stration

WESLEY MEMORIAL HOSPITAL—*Frank L. Hussey* The
interpretation of x ray findings in obscure gastric and
duodenal lesions, the use of x ray in conjunction with
surgery of the large bowel

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL—*Israels Kobak* Discussion of general physical therapy procedures

Tuesday Morning

COOK COUNTY HOSPITAL—*Israels Kobak* Physical therapy in posttraumatic conditions

Tuesday Afternoon

COOK COUNTY HOSPITAL—*I F Hummon* Physical therapy in infantile paralysis

Wednesday Morning

COOK COUNTY HOSPITAL—*Israels Kobak* Physical therapy in postoperative and traumatic infections

Wednesday Afternoon

COOK COUNTY HOSPITAL—*I F Hummon* Physical therapy in neurosurgical and neurological conditions

Thursday Morning

COOK COUNTY HOSPITAL—*Israels Kobak* Physical therapy in low back conditions

Thursday Afternoon

COOK COUNTY HOSPITAL—*I F Hummon* Manipulative treatment in low back conditions

Friday Morning

COOK COUNTY HOSPITAL—*Israels Kobak* Physical therapy in bursitis

Friday Afternoon

COOK COUNTY HOSPITAL—*I F Hummon* Physical therapy in the prevention of deformities

ST. LUKE'S HOSPITAL—*H F Mock* and *John S Coulter* Reconstructive cases in physical therapy

OPHTHALMOLOGY

Monday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*A C Krasne* Fundus diagnosis

CHILDREN'S MEMORIAL HOSPITAL—*G Guider* Orthoptics

COOK COUNTY HOSPITAL—*E B Fowler* Fundus diagnostic clinic

MERCY HOSPITAL—*C F Schaub* *F I Barnett* and *F A Roling* Fundus clinic

MICHAEL REESE HOSPITAL—*Philip Halper* Orthoptics

RUSH MEDICAL COLLEGE—*Dr Holmes* Orthoptics

Tuesday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL—*George Guider* Orthoptic training classification of squint

Sanford R Gifford Concomitant and paralytic squint

RUSH MEDICAL COLLEGE—*Dr Wilder* Histopathology

Tuesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*C I Drenay* Orthoptics

COLUMBUS HOSPITAL—*M Goldenburg* Eye clinic

COOK COUNTY HOSPITAL—*C F Yeager* Medical ophthalmology

MERCY HOSPITAL—*C F Schaub* and *H C Voris* Neuro ophthalmology Presentation of cases with fundi perimetric field findings discussion of diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

MICHAEL REESE HOSPITAL—*T M Shapira* Fundus clinic

RUSH MEDICAL COLLEGE—*Dr Jacobson* Fundus clinic

ST. LUKE'S HOSPITAL—*E A Vorisek* Clinical cases

Wednesday Morning

COOK COUNTY HOSPITAL—*Sanford R Gifford* Retinal detachment

RUSH MEDICAL COLLEGE—*H F Moncreiff* Cataract

Wednesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*S S Blankstein* End results of retinal detachment operations

CHILDREN'S MEMORIAL HOSPITAL—*R C Gamble* and *E A Vorisek* Diagnostic clinic

MERCY HOSPITAL—*C F Schaub* *F I Barnett* and *E A Roling* Fundus clinic

MICHAEL REESE HOSPITAL—*S J Meyer* and *D Snyder* Retinal detachment clinic

ST. LUKE'S HOSPITAL—*J Walsh* Clinical cases

U. S. MARINE HOSPITAL—*Alfred V Murray* Eye injuries

Thursday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*L Bothman* Macular disease

COLUMBUS HOSPITAL—*M Goldenburg* Eye clinic

COOK COUNTY HOSPITAL—*E B Fowler* Fundus clinic

MERCY HOSPITAL—*C F Schaub* and *H C Voris* Neuro ophthalmology Presentation of cases with fundi perimetric field findings diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

MICHAEL REESE HOSPITAL—*Jack Cowan* Glaucoma clinic

ST. LUKE'S HOSPITAL—*Frank F Brautley* and *J W Clark* Clinical cases

Friday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*Dr McShelley* Cataract results

CHILDREN'S MEMORIAL HOSPITAL—*R O Riser* Diagnostic clinic

RUSH MEDICAL COLLEGE—*E Selinger* Medical ophthalmology

ST. LUKE'S HOSPITAL—*R C Gamble* Clinical cases

Day to be Announced

HENROTIN HOSPITAL—*George W Mahoney* *E A Roling* and *Irving Barnett* Eye clinic



Painting by Sir Joshua Reynolds

Original Engraving by W. Pons Sharp

John Hunter

1728 1793

SURGERY

GYNECOLOGY AND OBSTETRICS

An International Magazine, Published Monthly

VOLUME 65

AUGUST, 1937

NUMBER 2

PREGNANCY COMPLICATING BONE TUMORS

LEON S. McGOOGAN, A B, M D, Omaha, Nebraska

IN THE last few years 10 instances of bone tumors complicating pregnancy have been observed. Literary research has revealed widely scattered references, and isolated case reports of this interesting subject, but there has been no comprehensive review of the entire problem in the last 50 years. As material was assembled it naturally divided itself into the following subheads: (a) the effect of pregnancy upon neoplasms in general, (b) the effect of pregnancy upon bone metabolism, (c) the effect of pregnancy upon bone tumor, a review of the literature, presentation of cases, and discussion of each group.

THE EFFECT OF PREGNANCY UPON TUMOR GROWTH

Emge has reviewed this problem. He observed the growth of neoplasms in the pregnant and non-pregnant animal comparing one with the other. He concluded that the growth of neoplastic tissue will be affected by a pregnancy only as that tissue is affected by the local and remote bodily changes incident to pregnancy, i.e. changes incident to increased blood vascular supply and hormonal stimuli, the ultimate result depending upon the duration of gestation, that pregnancy as a rule does not influence growth rate or size of neoplasms beyond certain reactions of which retardation is the most frequent, that in many

instances the growth rate remains unaffected and only on rare occasions is acceleration observed, and finally that at the termination of pregnancy the neoplastic tissue resumes its primary growth rate.

It has not as yet been proved that pregnancy favors the inception of malignant degeneration of tumors.

In his extensive review, Emge mentions many types of tumors, but he does not mention tumors of the bones. It can be assumed, however, that his conclusions would be applicable to bone tumors. The growth of neoplastic tissue, therefore, in or of the bones, primary or metastatic would be "affected by a pregnancy only as that tissue is affected by the local and remote changes incident to pregnancy." Included in this group of reactions would be (1) increased vascularity in the pelvis and breast, affecting tissues in these areas, (2) changed hormonal activities, hence bony tissue sensitive to hormonal stimuli would show growth changes, and (3) as the metabolism of bone is modified during gestation, tumors of the bone might show increased or decreased activity.

THE EFFECT OF PREGNANCY UPON BONE METABOLISM

The whole subject of normal bone metabolism with its underlying physicochemical processes is not completely known. The deposition of the calcium phosphate complex is

dependent upon the amount of available calcium and phosphorus in the blood serum and the presence of an enzyme phosphoric esterase, in the bone (4)

The whole growth of bone, in addition, is under control of the endocrine system as has been demonstrated in the case of the gonads, pituitary, thyroid, and parathyroid glands (Cuthbertson)

Thomson and Collip give an excellent review.

The blood serum calcium level is maintained in part by absorption from the alimentary tract, normal levels demanding a diet balanced in respect to calcium, phosphorus, and vitamin D

Variations from the normal serum calcium level of 10 milligrams per 100 cubic centimeters of blood are frequent. Hypocalcemia is present in dietary and parathyroid deficiencies. Hypercalcemia is present in hyperparathyroidism.

The secretion of the parathyroid maintains the normal calcification of bone and the calcification of pathological areas in the healing processes (10) by a specific action. It raises the blood calcium level, the excess being obtained from the skeleton.

As to the exact chemical form in which the calcium phosphate complex is laid down and in which structure of the bone the storage is accomplished is still disputed. Bauer, Aub, and Albright and Lambie and his coworkers have brought forth evidence that the trabeculae of the bones form a mobile store of calcium. Bodansky and Jaffe, however, believe that the bone most recently laid down in whatever site is the most readily dissolved.

The calcium storage must surely be mobile in character, reduced on demand, and replenished when circumstances are favorable. Hunter and Aub demonstrated this with their work in lead poisoning.

As a result of the catabolic bone metabolism, calcium is put back into the blood stream, but is it available for bone metabolism? McCruden, and Bauer, Albright, and Aub believe that calcium once liberated from bones cannot be used again even while bone building is actively occurring. Bauer, Albright, and Aub studied the calcium metabolism during pregnancy and arrived at the conclusion that on a

low calcium intake the patient excreted the same amount of calcium as she would have been expected to do had she not been pregnant, suggesting that the calcium excreted is not available for fetal use or for growth during the building of bones. It also suggests that the calcium ingested by the mother is available first to the fetus and that she may use any left over after fetal needs are supplied. The depletion therefore of the maternal bones arises not as a withdrawal of calcium for fetal use but from an insufficiency of available calcium to meet the normal requirements of anabolic metabolism.

Thomson and Collip believe that there is a possibility of calcium being transferred from one part of the bone to another. Hamilton has produced evidence to show that the fetus just before birth accumulates a store of calcium which is used in bone growth just after birth.

When pregnancy occurs, metabolism in all its phases is altered and, as a result, bone metabolism is also affected. There is a gradual fall in the serum calcium during pregnancy, from the normal of 10.16 milligrams in early pregnancy to 9.4 milligrams in late pregnancy with many readings as low as 8 milligrams (5-8 14 15 17).

The normal hypocalcemia of pregnancy may be due to a variety of causes of which the greatest is no doubt due to the growth demands of the fetus. The calcium demand average is 0.1 gram per day over the entire gestational period (5). To meet this demand some investigators believe that a drain is placed particularly on the mobile store of calcium, depleting the maternal tissues and converting that calcium for fetal use. If the conclusions of McCruden and of Bauer and Albright and Aub are correct that endogenous calcium is unavailable for fetal use we must fall back upon the theory that the mobile calcium is depleted but not for fetal use and it cannot be replaced unless there is a surplus of available calcium after fetal needs have been supplied. The maternal anabolic calcium metabolism cannot keep pace with the catabolic process, when the available calcium supply is lowered as it is in pregnancy, and if during pregnancy dietary factors which lead to hypocalcemia are also operating then the

maternal serum calcium may tend to fall more rapidly. In other instances the hypocalcemia may be due to an altered function of the ductless glands, particularly the parathyroids, for pregnancy makes demands upon the parathyroids often unmasking a latent insufficiency (8).

On the other hand a pre-existing hyperparathyroidism, either latent or active, could be further activated by pregnancy and a hypercalcemia result. Again this calcium is not available for either fetus or mother and is excreted.

In contrast to depletion of bone there is the possibility of the opposite reaction—i.e. increased storage. This may occur as the result of greater calcium intake or changed endocrine stimuli or both. Stander has reported small bony exostoses inside the skull developing during pregnancy.

In summary, then, bone metabolism is altered by pregnancy. Locally the bones are depleted of their calcium phosphate complex by normal and altered metabolic processes, the fetus using the available supply before the mother's needs can be supplied.

Available calcium supply and hormonal activity may normally affect bone tumor growth. As these factors are altered during pregnancy, in this way will pregnancy indirectly affect bone tumor growth. In addition the local factor of blood supply changes may also play a part. Hyperemia leads invariably to osteoporosis and partial reversion of the bone to a primitive non-specific connective tissue, and ischemia to an increase in calcification and sclerosis (16).

EXOSTOSES AND OSTEOCHONDROMA

These tumors with the groups called osteoma and chondroma form one large group of tumors according to Geschickter and Cope-land. The classification has resulted from the incomplete study of the tumors. If only a small section of a tumor is removed for microscopic study and if the whole tumor is not sectioned, the pathological diagnosis will vary as the section contains cartilage, bone, or both. The literature subdivisions will be followed as much as possible for the sake of clarity. A summary of the entire group will then be made.

Malignant changes These tumors may undergo malignant changes. Geschickter states that in the single lesion the tumor may undergo malignant changes after the patient has reached 30 years of age. In the multiple lesions malignant changes are frequent in the ribs, particularly when associated with lesions of the small bones.

Exostoses Muller, and Tarnier and Budin both give excellent reviews of the literature. The growths are situated anywhere on the pelvic bones but particularly at the attachment of the tendon. There may be single or multiple pelvic tumors and the size and shape varies.

The tumors grow slowly and in many instances the size of the tumor may be obstetrically insignificant for a number of years. They may become dangerous, first, because of encroachment upon the size of the pelvic canal, second, because of possible perforation of overlying soft parts including the uterus (24), and, third, because of necrosis of soft parts resulting from sustained pressure occasioned during labor (42). The fetus may also be injured as in the case reported by Schrank (38).

As to the effect of pregnancy upon these tumors there is little definite information, but one gains the opinion that pregnancy has little if any effect upon the tumor growth rate. Marchant, Smith, and Schrank mention the slow growth of the tumors in their cases. One author thinks the tumors grow more rapidly (52).

Osteoma Careful studies of the cases called osteoma would undoubtedly show that these tumors were in reality osteochondroma. The tumors are larger than the exostoses and if not carefully sectioned their true character would be missed.

Cazeau and Tarnier in 1884 recognized only the cases of MacKibbin and Leydig. Ten years later Winckel (50) listed 9 cases. Since then West, Finzi, and Broadbent have each reported a case. The microscopic description of the tumor in West's case is typical of an osteochondroma.

Osteochondroma and chondroma Schoppig in 1907 made an exhaustive review of the literature concerning pelvic osteochondroma.



Fig. 1 Osteochondroma of the left ilium

and chondroma. He discovered 47 cases which were associated with pregnancy, and reports a case of his own. Muller mentions 7 cases not listed by Schoppig and additional cases have been reported by Deville, Ferroni and Lederer, bringing the total number to 58. Of the 58 cases 5 were considered as malignant: those of Vaill (46-47), Bartscher, Jardine, Tauber, and Lederer. These will be considered under a separate title, chondromyxosarcoma.

A review of the original references was undertaken to discover what clinical effect if any the pregnancy had upon the growth rate of the tumor. In the benign groups this was recorded only five times. Some growth rates seemed to be increased (37-43), some not disturbed (18, 40, 49).

CASE REPORTS

CASE 1. Covenant Hospital No. 30457. The patient, aged 20 years, white female, was admitted on October 15, 1935, complaining of a lump on the left side. Two years previously the patient noticed a small, slowly growing lump near the anterior superior spine of the left ilium (Fig. 1). The mass on admission was the size of a goose egg. She became pregnant in October, 1934, and was delivered by a cesarean section in July, 1935, because of pelvic disproportion. She believes that the tumor did not grow more rapidly during her pregnancy. Other phases of the history are not essential.

Stereoscopic anteroposterior roentgenograms of the pelvis show an irregular lobular and rounded tumor mass measuring about 6 by 9 centimeters arising from the crest and posterior aspect of the left ilium and protruding forward over the pelvic brim. The upper femora show thickening and short-

ening of the femoral necks and the femoral heads are rotated forward and laterally. Small exostoses are present along the medial aspects of the femoral necks and on the right pubis near the symphysis and on the left pubis in the mid part of the ascending ramus. Small exostoses are also present along the phalanges.

On October 16, 1935, under gas anesthesia the tumor was removed by Dr. P. W. Tipton. She made an uneventful recovery and was dismissed on October 20, 1935. Microscopic sections showed the tumor to be composed of cancellous bone alternating with fibrous tissue. There was no evidence of malignancy.

Diagnosis: Osteochondroma.

CASE 2. Lutheran Hospital No. 2580. Courtesy Dr. L. Hanisch. The patient, a white female, age 28 years, secundipara, trigravida, was admitted to Lutheran Hospital March 2, 1933. The patient's first pregnancy was normal and terminated after a 6-hour labor. The second pregnancy in 1931 was normal but during labor a pelvic examination revealed a firm tumor about the size of a goose egg which was attached to the left half of the sacral area and seemed to be just under the vaginal mucosa. The cervix was almost fully dilated but no descent of the head occurred because it was held up by the tumor described. In view of the fact that the tumor was accessible, an incision of the vaginal mucosa was done and the tumor easily removed. The wound in the vagina was closed and the anesthesia discontinued and the child was delivered spontaneously. The total duration of labor was 9 hours. The tumor was an osteochondroma.

The last menses preceding the onset of the present pregnancy began June 10, 1932. The gestation continued normally. A pelvic examination revealed a recurrence of the osteochondroma, recurring as numerous small, grape-sized tumors and encroaching somewhat upon the size of the pelvic canal. The patient was delivered of a normal female child by classical cesarean section. She had an uneventful convalescence and she and her child were dismissed from the hospital on March 16, 1933. An examination was done 6 weeks later and the masses were much smaller. At the present time there has been no evidence of recurrence.

TREATMENT

The obstetrical care and type of delivery would of course depend upon the location of the tumor and the amount of encroachment upon the pelvic canal by the tumor. Some patients could be delivered through the vagina, others would require cesarean section. A few patients might be delivered by the vaginal route after removal of the tumor through the vagina as was done in the cases of Drew and Burns, and the case which has been reported above.

Abdominal removal of the tumor might be considered and indicated in some instances during gestation. The enlarged uterus would render a difficult operation more difficult and it would be wise to deliver that patient at term, attempting surgery of the bone tumor at a later date. If cesarean section were done a biopsy should be performed to ascertain a definite diagnosis particularly if malignancy were suspected.

Extrapelvic osteochondroma. Osteochondroma may occur in bones other than those of the pelvic girdle and complicate pregnancy only by their presence. Review of the literature has not revealed such an instance. A case is reported below.

CASE 3. Methodist Hospital No 107,799. The patient was a young white female, age 29 years, who entered the hospital May 20, 1934, complaining of a lump on the right shoulder blade. The patient first noticed a small lump the size of a small walnut on the outer lower aspect of her right shoulder blade 7 years ago. She was pregnant at the time. There seemed to be, however, no increase in size or trouble caused by the tumor, until 18 months prior to admission, at which time it began growing rapidly (Fig. 2). There were no intervening pregnancies.

On examination the general physical examination showed a mass about 14 centimeters in diameter fixed to the right scapula. There was no tenderness or impairment of motion.

An excision of the right scapula with the tumor mass was done by Dr. Robert Schrock. Pathological examination showed the tumor to be an osteochondroma. Convalescence was uneventful. A follow up examination done July 17, 1934 revealed an excellent anatomical and functional result.

Inasmuch as the tumor made its original appearance during gestation the problem of the influence of the pregnancy upon its original growth must be considered. Did the pregnancy through its hormones activate an inclusion rest (34) into growth which was only slight, or was it purely a happenstance that the tumor appeared at this particular time? Another question is what caused the tumor to remain quiescent for 5½ years and then suddenly start to grow—was its growth activated by the same condition as that which caused its original appearance? If so, certainly the pregnancy played little or no part in the picture.

Multiple osteochondroma. Two cases of multiple osteochondroma complicated by a preg-



Fig. 2 Osteochondroma of the left scapula

nancy have been reported. Jacobson reported a case in 1921 and Blackaby in 1931. In the former instance there was a definite family history of this deformity. In a recent personal communication Jacobson (31) stated that the patient was delivered spontaneously by a midwife and that he had since lost track of the patient. In Blackaby's case, which was delivered by hysterotomy at term, there again is no mention of the effect of pregnancy and the puerperium. Those tumors may undergo secondary malignant changes, becoming a chondrosarcoma and causing death.

CASE 4. Mrs. N. W. M., nullipara, primigravida, had her last period November 10, 1933. In February, 1934, she noticed a small hard lump deep under the right breast. It was about the size of a walnut, hard and immobile. In May, because the tumor increased in size, she entered the University Hospital in Omaha. At that time the patient had lost considerable weight, was suffering from a nonproductive cough and pain in the right axilla and arm.

Examination of the patient showed a moderate lymphadenopathy of the cervical glands. Under the right breast and extending upward and toward the axilla was a large mass 18 centimeters in diameter and about 10 centimeters in depth above the chest wall. The mass was large, regular in contour, nontender, unattached to superficial skin or breast tissue,

but firmly attached to the chest wall. Breath sounds were absent over the entire right chest except at the apex.

In the abdomen the uterus was enlarged by a 7 months pregnancy.

There was a firm hard enlargement of the proximal end of the humerus and similar lesions were noted on the distal end of the proximal phalanx of the third digit of the right hand and on the distal end of the right femur. (Her father also had multiple exostoses.)

Roentgenographic study of the right hand shows a bony exostosis 8 by 12 millimeters rising from the distal end of the proximal phalanx of the middle finger. The chest shows a density overlying the right fourth to sixth ribs anteriorly in the region of the superficial mass. The origin of this tumor mass is probably from the fourth rib or adjacent tissues and has grown inward into the chest as well as outward into the thoracic wall. The skeleton shows multiple exostosis of a bony consistency arising from the femoral neck and the humeral neck.

The patient was then dismissed to her physician who treated her with Coley's toxin. Very little change was noted in the local or general condition.

On August 17, 1934, she was delivered of a 7½ pound baby girl by cesarean section because of marked respiratory and cardiac embarrassment. She made an uneventful recovery from her delivery but her general condition became worse. The thoracic tumor became necrotic and drained through the skin. She died May 22, 1935.

The patient presented a family history of skeletal abnormalities. Her bone lesions gave her no difficulty until during the third month of pregnancy when one of the rib lesions began to grow rapidly. Did pregnancy activate the tumor growth rate? The tumor was situated near the right breast which undergoes changes during pregnancy and it is reasonable to believe that activation did occur as a result of pregnancy.

Unfortunately, microscopic examination was not done so the exact histology could not be ascertained. It could be assumed to be a sarcoma from x-ray examination and case history. Did the malignant growth result from metabolic and hormonal changes brought about as the result of gestation? One case cannot answer the question.

Chondromyxosarcoma. Five cases of chondromyxosarcoma were mentioned in the preceding section. In 3 instances the growth rate of the tumor was mentioned. In Vaille's, Jardine's, and Lederer's cases the tumor grew rapidly. Apparently then, pregnancy seems to

accelerate the growth of some tumors. The problem of therapy is difficult. If seen late in pregnancy, delivery followed by deep x-ray therapy should be done. The manner of accouchement ideally would be abdominal hysterotomy at which time biopsy material could be obtained. In the cases discovered early in pregnancy the problem becomes difficult. The tumors apparently grow rapidly under the influence of a pregnancy and should one perform an abortion in an attempt to save the mother when our present therapy is so hopeless? Deep x-ray therapy during pregnancy is not indicated as abortion or damage to the child occurs. In some instances it might be better to consider the future of the child than that of the mother. Every case, certainly, should be considered individually and the wishes of the patient and family given careful consideration.

FRACTURES

It has been previously recorded that injury or trauma was one of the etiological factors in the production of tumors of the exostosis group. The tissue injured or traumatized in these cases where there is no evidence of bone fracture is precartilaginous connective tissue. Interesting cases have been reported by Blatner, Winckel (51), and See and Tarnier.

CASE 5. University Hospital No. 51906. The patient, a married white female aged 27 years primigravida, was admitted to the hospital November 19, 1935, in labor. In 1928, 7 years prior to admission, the patient was in an automobile accident sustaining a fracture of the pelvis and rupture of the bladder. She made an uneventful recovery from the accident. She married in 1931 and this was the first gestation. The last period occurred February 11-14, 1935.

The general examination was essentially negative. The abdomen was enlarged by a full term pregnancy, the presentation and position being diagnosed as left occiput posterior with head well fixed in the pelvic inlet. The external pelvic measurements were within normal limits. A vaginal examination was done because of the history of pelvic fracture. On the descending ramus of the pubic bone a projection was discovered.

A roentgenogram of the pelvis was made (Fig. 3). An anteroposterior roentgenogram with patient in the semisitting position showed a true conjugate of 10 centimeters, left oblique diameter 9.5 centimeters, and the right oblique of 10 centimeters with the fetus presenting with the occiput to the left.

Labor was prolonged, the duration being 41 hours and 5 minutes, the first stage alone lasting 37 hours. The delivery was spontaneous. There was considerable molding of the head. Convalescence and puerperium were uneventful.

SARCOMA

In addition to the chondrosarcomas previously mentioned, Muller under the titles of "Sarcoma" and "Carcinoma" mentions 9 cases. Daubeuf, Lauwers, Zeller, Lees, Barnes and Barnes, and Hardoun and Brault, each report 1 case and Cragin mentions 2 cases.

Vaile states that these tumors grow rapidly during pregnancy and that some of them become much softer during the puerperium. A study of the cases was made with these statements in mind. In the 17 cases cited from the literature, tumor growth was observed clinically to be rapid in 9 instances (55, 56, 58, 59, 60, 61, 64, 66, 68), but it is difficult to determine or to state with any degree of accuracy that the growth rate was influenced by pregnancy and/or the puerperium. Three patients (57, 63, 69) died as a result of cesarean section and tumor growth rate was not noted in these or the other 5 cases.

The following case, one of fibrosarcoma of the left femur, was observed prior to, and through, a pregnancy.

CASE 6 University Hospital No 50379. The patient, a white female aged 30 years, was admitted to the University Hospital March 11, 1933. About 18 months prior to admission she noticed a lump in the upper part of the left leg. She then noticed some weakness in the leg but had no pains until about 2 months prior to admission when she twisted her leg. Following this there was an increase in the size of the lump. There was a loss of 9 pounds in 2 years.

The patient was an emaciated white girl whose general physical examination was essentially negative. Locally the upper third of the left thigh showed a fusiform enlargement, more marked on the anterior, than on the posterior surface. The enlargement measured 24 inches in circumference as compared with the 19 inch circumference of the right thigh. The length of the left leg was 32 inches, the right 35 inches.

Röntgenogram (Fig. 4) showed a large tumor mass in the soft tissues of the upper thigh, with some irregularity of contour especially in its medial aspect. There has apparently been an extension of the new growth into the greater and lesser trochanter of the femur at which point there has been some bone destruction with several spicules of the bone extending into the soft tissues in the region of the lesser



Fig. 3. Old fracture through the acetabulum and descending ramus of the pubis, on the right with some displacement deformity of the latter associated with calcification of excess cartilage at point of union.

trochanter. There appears to be some involvement also along the under surface of the femur with some narrowing of the femoral neck. The bones of the pelvis, head of the femur, and the greater trochanter show marked decalcification.

A biopsy was done March 16th, 1933, and the diagnosis was fibrosarcoma with a high degree of malignancy.

Patient was given a course of deep x-ray radiation with 600 r units through four ports of the femur.

She was dismissed on April 1, 1933. She returned to the x-ray department from time to time for x-ray treatments (Fig. 5).

She occasionally had periods of amenorrhea which were not present prior to radiation. She had a normal period beginning September 15, 1934, and then amenorrhea. She was not seen from October, 1934, until April, 1935, when she again presented herself. She complained of recurrence of pain especially upon walking, weakness, growth of the tumor, and enlargement of the abdomen. Pregnancy was suspected and a roentgenogram of the abdomen revealed a fetus (Fig. 6).

She delivered spontaneously on May 10, 1935, the infant was normal and survived. She was readmitted to the hospital on June 6, 1935, complaining of rapid growth of the tumor since her delivery. There was no pain. The tumor mass measured 28 inches in circumference and there was a 20 degree contraction of the knee (Fig. 7).

X-ray examination revealed that the soft tissues of the upper left thigh were increased in density and size and multiple shadows (?) were noted along the femoral shaft and through the soft tissues about and below the new growth which had destroyed all the section of the upper femoral shaft extending from the trochanteric region to a point 15 centimeters below. There is a sequestered fragment of the femoral shaft 20 by 4 millimeters lying 1.5 centimeters medial to the lesser trochanteric area. The femoral shaft through this region shows multiple areas of bone destruction, which appear to extend down along the cortex giving it a moth eaten appearance. There are no apparent metastases in the lung fields or skeletal structures visualized.

The blood hemoglobin was 40 per cent (Sahli) red blood cells 2,210,000 white blood cells, 7,500. She was given two blood transfusions of 250 cubic centimeters each. No further roentgenogram was given because of the condition of the overlying skin. Patient was dismissed. She died about 1 year later.

The growth of the tumor as observed by the x ray, i.e. decalcification of the bone, was increased during pregnancy and puerperium. As judged by clinical symptomatology the patient was definitely worse as a result of the gestation and by actual measurement the tumor had increased in size. Because of the close proximity of this tumor to the pelvic girdle might not the conclusion be drawn that what happened in this tumor might also happen in similar tumors of the pelvic girdle? How these alterations in growth and decalcification are brought about, whether by pregnancy with its altered hormones, by change in vascular supply, by the physiological changes in calcium metabolism or by all three factors is, of course, open to discussion.

TREATMENT

In general the obstetrical treatment will depend upon the duration of gestation and the amount of pelvic disproportion. Vaile recommends cesarean in all cases for fear of the trauma sustained during delivery activating the tumor or causing metastatic lesions. Lauwers attempted removal of a fibrosarcoma when the patient was in her eighteenth week of gestation. The tumor was removed, the patient however aborted on the third post-operative day. She survived both incidents, but the author concludes "that there will probably be a recurrence of the tumor within a short time."

Hardoun and Brault treated their patient with deep x ray therapy, trying to protect the child with lead sheets. The child, however, when delivered at the seventh and one half month of gestation, lived only 4½ hours, the postmortem revealing a profuse sclerosis evidently due to radiotherapy. Two months after delivery the patient's general condition was much worse and it was evident that she would not long survive. This single case certainly emphasizes the fact that radiotherapy is contra indicated in the treatment of pelvic

osseous tumors if the pregnancy is to be continued.

The problem of interruption of the pregnancy with subsequent surgery or radiation therapy should be considered only in early gestation, but each case should be considered on its own merits. With our present inadequate therapy of these tumors are we justified in sacrificing both lives? Lees, in 1895 made the observation that it is fortunate for the fetus that the majority of these tumors are discovered late in pregnancy.

GENERALIZED OSTEITIS FIBROSA CYSTICA AND HYPERPARATHYROIDISM

Generalized osteitis fibrosa cystica or von Recklinghausen's disease is most frequently seen in cases of hyperparathyroidism. It is possible that hyperparathyroidism may exist in the absence of hypercalcemia, for the parathyroids are only one factor in the maintenance of the serum calcium level. The reverse may also be true that hypercalcemia may exist with normal or hypoparathyroidism.

Pregnancy apparently aggravates the condition the parathyroid activity being increased so that further decalcification occurs. The available calcium is used by the fetus and none or very little can be utilized by the mother. Hyperparathyroidism tends to raise the serum calcium. The pregnancy *per se* tends to lower it. Blood calcium readings might in some instances be most confusing. The result of course, would depend upon which one of the two factors was dominant. In very mild cases, hyperparathyroidism in the sense of increased functional activity as a result of the pregnancy might exist without hypercalcemia, or indeed, in the presence of low values of serum calcium (82).

Five cases have been reported in the literature (71 73 74 76).

One case of osteitis fibrosa cystica without hyperparathyroidism had been observed at the University of Nebraska Hospital.

CASE 7. University Hospital No 37496. The patient aged 31 years, white housewife was admitted to the University Hospital January 6, 1932 with the following history. Following a leg injury at the age of 3 years she has had recurrent attacks of pain in the left hip. She began to menstruate at the



Fig 4



Fig 5



Fig 6



Fig 7

Fig 4 Fibrosarcoma of the left femur showing extension of the new growth into the lesser trochanter, and spicules of bone extending into the soft tissue

Fig 5 Fibrosarcoma of femur Appearance 10 months later after radiation showing calcification in the region of the bony proliferation medially to and surrounding the lesser trochanter

Fig 6 Fibrosarcoma of the femur Appearance 25 months after first film patient then being 7 months pregnant Increased destruction of bone present The cortex, previously well calcified and sclerotic now appears irregularly invaded through the medial half of the shaft

Fig 7 Fibrosarcoma of the femur Appearance 1 month postpartum, marked destruction of upper femoral shaft

age of 13 (1914) and noticed that the discomfort in her hip was always worse at that time She married in 1920 at the age of 19 She became pregnant in February, 1921 and shortly after began to complain of severe pain increasing in severity as pregnancy progressed She delivered a full term child in November, 1921, and had a second child just one year later in November, 1922 During the second pregnancy the pain in the hip was more severe than that which occurred during the first pregnancy Following the second pregnancy the pain became steadily worse coming on in attacks and each attack lasting about 1 month During 1923 and 1924 there occurred occasional pains in the left tibia and the patient noticed a gradual bowing of the femur with the convexity outward

She entered the dispensary of the University August 28 1924, with the complaint stated A roentgenogram was taken with the following report "Multilocular cysts involving almost the entire upper third of the left femur, and the ramus of the ischium and pubis There is an incomplete fracture of the shaft of the femur at the junction of the upper and middle third

The patient was admitted to the hospital on September 8, 1924, and before an application of a cast could be done she suffered a spontaneous fracture, with 6 inches of overlapping The patient made a very slow recovery and it was not until 1929 that the patient felt well and could walk with little or no limp During that year and 1930 she felt very well and had practically no discomfort

A regular period occurred April 25-30, 1931, following which there was amenorrhea Within a few

weeks of the last period there was a recurrence of the pain in the hip The patient was able to do her usual light household duties for the next 3 months During the fourth month of gestation the patient could not bear weight on the left leg without causing pain in the left hip This continued for 2 months and then diminished somewhat

Examination showed a well nourished, well developed female who walked with a decided limp, favoring the left leg There was some enlargement in the neck of the femur There was shortening of 1 inch Motion was slightly limited in all planes

The remainder of the examination was not remarkable except for the gestational tumor which filled the abdomen The fetal head was floating above the pelvis brim, the position a left occiput anterior

The blood serum contained 55 milligrams of phosphorus per 100 cubic centimeters and 11 milligrams of calcium per 100 cubic centimeters Other laboratory examinations were within normal limits

X ray study (Figs 8 and 9) of the left femur and the tibia and fibula showed the normal trabeculations through the upper half of the femoral shaft to have been replaced by an irregular cystic lesion which has expanded the width of the shaft and narrowed the cortex, this extends from the epiphyseal line downward to the middle of the shaft There appears to have been an old fracture in the subtrochanteric region through the cyst The cyst is crossed irregularly by aberrant trabeculae

A study of the pelvis shows the left pubis and ischium to be involved by a similar lesion giving an expansion of the bone decalcification of its substance in an irregular manner with thinning of the

cortex and loss of the normal trabeculae. The left acetabulum protrudes into the pelvic inlet narrowing its diameter by about 15 millimeters from the left acetabulum to the right sacro iliac synchondrosis. There is also decalcification through the right pubis suggestive of less advanced cystic changes.

A study of the left leg shows a similar lesion extending throughout the shaft of the tibia and a small central cystic area in the middle of the shaft of the fibula (Fig. 9). There is about 5 degrees of medial bowing of the tibia and fibula.

Impression. Osteitis fibrosa cystica: old pathological fracture through the left femur and narrowing of the pelvis in its right oblique diameter by about 15 or 20 millimeters. She was seen in consultation by Dr. Herman Johnson of the orthopedic department who advised abdominal hysterectomy and sterilization because of the evidence of slow progressive character of the process, apparently increasing with each pregnancy and the possibility of other fracture occurring during delivery through natural channels.

On January 10, 1932, the patient began to have a few regular low abdominal pains and a classical cesarean section with salpingotomy was performed, spinal anesthesia being used. The child was of the male sex, cried spontaneously and was normal except for a slight elongation of the middle toe of each foot, a characteristic found in its mother and maternal grandfather. The patient made an uneventful recovery and was dismissed on January 24, 1932.

Re-examination was done on June 18, 1932. The patient felt well but had continued to have recurring attacks of pain in the left hip, short in duration and not severe if her activities were somewhat restrained. She had been instructed to take calcium lactate 0.3 and viosterol daily. She had not followed instructions rigidly but was definitely certain that the pain was always worse if she discontinued her medication. On May 9, 1934, the blood serum contained 5 milligrams of phosphorus per 100 cubic centimeters and 11 milligrams of calcium.

The reported case because of the blood chemistry is one which is not easily classified. As already mentioned a hyperparathyroidism may exist in the absence of a hypercalcemia and the diagnosis is confirmed or disproved by the examination of the serum phosphoric ester which is increased. It is also possible—at least theoretically—that in certain cases there would appear a remission of hyperactivity of the parathyroids and during such a time as the remission was present the blood findings would be approximately within normal limits. Such a possibility is suggested in Bever and Sorrentino's case which received only a course of hormone therapy over a period of 30 days and remained well. The case presented might

possibly have been in a quiescent stage, the symptoms aggravated somewhat by pregnancy but not accelerated, the parathyroids remaining within the normal limits of activity as judged by the blood chemistry studies.

Pregnancy or the puerperium apparently aggravates the condition as shown in the reported cases. Pregnancy should not be undertaken by women affected with the disease. If the woman does become pregnant all measures should be undertaken to effect a cure, and while being studied or treated precaution should be used to prevent a pathological fracture. Delivery should be accomplished in a manner that is safe to both mother and child.

Therapeutic abortion early in pregnancy might be considered but at present there is insufficient evidence to warrant or support such a procedure.

Two of the reported cases (74, 76) showed their onset following spontaneous interruption of the gestation; hence cessation of pregnancy will not always allay the process.

Future pregnancies in cases that are not cured should be avoided and in the cured cases probably may be undertaken without undue risks if they are properly spaced as to time interval.

SOLITARY CYSTS

The solitary bone cysts are common in young people, usually under 21 (75) and should be seen occasionally in the pregnant woman. However such a combination is apparently very rare. The following case report is therefore unique.

CASE 8. The patient, a young white female aged 23 years, was first seen by Dr. Schrock and Dr. Johnson on May 28, 1933. At that time she said she had noticed a gradual swelling in the lower end of the right ulna since August, 1931. She had a normal period in January, 1933, and then amenorrhea. Since the onset of her pregnancy the swelling has increased more rapidly. Examination revealed a fusiform thickening of the lower right forearm on the ulnar side. The patient is approximately 4 months pregnant. X-ray examination showed a multilocular cystic tumor of the lower 3 inches of the ulna (Fig. 10). She was given a course of deep x-ray therapy with some regression of the size of the tumor. The patient delivered in October, 1933, but due to a contracted pelvis the child was stillborn. Following delivery there was a further decrease in size of the



Fig 8 Osteitis fibrosa cystica. Irregular cystic lesions have replaced the upper half of the left femur. Similar lesions are present in the left pubis and ischium. The left acetabulum protrudes into the pelvic canal.

tumor. An examination done on September 16, 1935 showed a completely functional wrist with excellent contour. The x-ray showed the process to be entirely arrested.

The growth rate of this tumor was apparently accelerated by the onset of a pregnancy with its attendant bodily changes in the calcium metabolism and activity of the endocrines, especially that of the parathyroids. Unfortunately, blood calcium studies were not made.

The tumor growth responded to the accepted type of therapy, not requiring an increase in the dosage. Solitary cysts, therefore—at least in this one case—have an increased growth rate during pregnancy, respond to the accepted therapy, and are not an indication for an interruption of a gestation.

CANCER—PRIMARY AND METASTATIC

Cancer of the bone may be either primary or secondary and its occurrence in a pregnancy is most rare. Metastatic lesions of the bone are most common in the female and usually are secondary to breast malignancies. The majority of such cases, however, occur late in the childbearing era, accounting for a large part of the infrequency of the complication.

One case of "primary carcinoma" of the sacrum was reported by Berry, in 1886, and is famous, for it is apparently the only instance



Fig 9 Osteitis fibrosa cystica. Fibula and tibia of the same patient.

He does not state whether or not the pregnancy affected the growth of the tumor.

Jarcho mentions an instance of multiple metastatic lesions of the skeleton in a woman of 25 who had had a mastectomy done for carcinoma 18 months prior to admission to the hospital. Large metastatic lesions were demonstrated in the pelvis by pelvic examination and by x-ray. These tumors obstructed the birth canal, and the patient was delivered by cesarean section. Again there is no statement made as to how the progress of the disease was affected by the pregnancy.

CASE 9. History through courtesy of Dr R. Schrock and Dr H. Johnson. The patient was a white female, aged 35 years, who was first seen on December 27, 1933. She gave the history of a mastectomy performed in 1930 for a carcinoma of the breast. She had been well until September, 1933, when she twisted her right upper leg and hip. There was some pain at the time of the injury, and this had progressed and she walked with a slight limp. Roentgenograms revealed a pathological absorption of the neck of the right femur secondary to carcinoma of the breast. About 600 r units of deep



Fig. 10. Solitary bone cyst of distal end of the left ulna showing regression of tumor under treatment during pregnancy and puerperium

x ray therapy were delivered anteriorly and posteriorly over the region of the right hip. During the first 8 weeks following the treatment there was relief of pain. On March 14, 1934, she returned complaining of pain in the hip associated with some difficulty in the use of the right leg and thigh. Fluoroscopic examination showed no gross deposits in the chest. X ray examination of the hips was done and the coxa vara at the right femoral neck had been increased. A roentgenogram of the lumbosacral spine was made. No abnormality was found but a fetal skeleton was demonstrated. The patient admitted the possibility of pregnancy and stated that her last period had occurred 5 months previously. The patient then visited another city where a therapeutic abortion was done. The consultant being of the opinion that the pregnancy was definitely affecting the progress of the disease. She was seen again May 23, 1934. The pain in the hip was increased and in addition some swelling was present in the right hip. Over the hip region 900 r units were administered

and a sterilization dose of roentgen therapy was administered over the pelvis. The patient continued to fail and died one year later from extensive pulmonary metastases.

CASE 10. University Hospital No 52476. The patient, white married female aged 30 years, was admitted to the University Hospital January 21, 1936. The patient states that on or about September or October, 1934, she noticed a hard nodule in the upper outer quadrant of the right breast. In February, 1935, a radical mastectomy was done. A month after her dismissal she developed a backache in the lumbosacral area which has persisted. On May 24, 1935, she had a regular normal period and then a total amenorrhea. About the same time she noted a scabbing of the lower angle of the wound and in September pus began to drain from this area. Examination revealed a recurrence of the original lesion for which she was given deep x ray therapy. In spite of treatment the lesion continued to grow and a few hard masses appeared in the infraclavicular and axillary areas.

The pregnancy developed normally, the only difficulty being a rheumatic feeling in the hips and lower back, loss of appetite and lassitude. She fell into labor on January 20, 1936, and after a 2 hour labor was delivered spontaneously. She was admitted to the University Hospital for care of herself and her premature infant.

The patient was a moderately well nourished female 30 years of age. The face was thin and her cheeks were sunken. The neck was negative. The left breast showed no masses or scars. The right breast had been removed and there was an area of superficial ulceration about 10 by 14 centimeters in size. Small round pea-sized nodules were scattered along the line of the incision and the edges of ulcerative areas and larger nodules were in the axillary and infraclavicular areas. Posteriorly in the mid-clavicular line the eighth or ninth rib was enlarged and tender. The lungs were clear, the heart was negative. The blood pressure was 128/70. The



Fig. 11. Metastatic carcinoma of the right ilium. Anteroposterior study of the pelvis showing irregular destruction of the right ilium.

lower edge of the liver was palpable and extended three fingers breadth below the costal margin. The liver felt nodular and pressure over the liver area caused the patient some pain. The spleen and kidneys were not palpable. The fundus of the uterus was slightly below the level of the umbilicus. The extremities were negative, with no deformities, edema, or varicosities. The reflexes were all normal. Laboratory examination was negative. The urine was negative, the blood hemoglobin 80 per cent (Sahl), the red blood cells, 4,270,000 and white blood cells 14,800.

Roentgenograms of the skeleton were done by Dr H B Hunt.

"Anteroposterior radiographic study of the dorsal lumbar spine and pelvis shows irregular destruction of the right ilium above the acetabulum and an area of destruction in the ninth rib posteriorly indicating metastases. No gross destruction or collapse of the vertebral bodies was discerned, the hilar and perihilar markings were accentuated bilaterally, which is also consistent with metastases. Small areas of destruction are suggested in the upper end of the right tibia, and the junction of the upper and middle third of the left humerus consistent with metastases."

The patient was not permitted to lactate. She was dismissed after 17 days of observation, her only treatment being sufficient x-ray therapy to inactivate the ovaries. The child gained well on artificial formula and was dismissed in good condition.

Dawson, Lee, Kilgore, and Trout, all present cases in which the growth of the primary and secondary lesions in carcinoma of the breast was apparently rapid after or during the incident of pregnancy and/or lactation. There are no instances of the occurrence of a pregnancy after the appearance of bone metastases in their series.

Lee advises sterilization by radiotherapy of women treated for mammary carcinoma before the menopause or the interruption at an early stage of a subsequent pregnancy.

Geschickter, in discussing skeletal metastases in carcinoma of the mamma, states that the interval between the appearance of the primary tumor and the appearance of the metastases to bone was 32½ months, and that the duration of life thereafter was from 7 to 18 months, depending upon the type of tumor and the radiation. In the first case the time interval was 3 years and the duration of life afterward was 18 months. It is doubtful if the pregnancy in this instance lent any acceleration to the progress of the disease. Certainly the interruption of the pregnancy did not allay the rapidity of the tumor growth, for the

patient lived 18 months, the same time (theoretically at least) as she would have lived had she not been pregnant.

A review of the first case raises the question as to the therapeutic value of abortion in this type of case. The prognosis is already extremely poor, and should one sacrifice both individuals in an effort to save one—especially one who already has a hopeless prognosis?

In the second case the evidence of local recurrence and the occurrence of the pregnancy were almost simultaneous. Undoubtedly in this instance the pregnancy did, through its hormones, accelerate the growth rate of the tumor. The inactivation of the ovaries at the time of the mastectomy, or a very early therapeutic abortion might have given the patient a longer life span.

The performing of a therapeutic abortion after the occurrence of bone lesions seems to the author to be contra-indicated except in those cases of scirrhus carcinoma of the breast in which bone lesions occasionally exist for many years, the host comfortable and requiring little or no therapy.

BIBLIOGRAPHY

- 1 BAUER W, AUB J G and ALBRIGHT, F J *Exper Med* 1929, 49, 145
 - 2 BAUER, W ALBRIGHT, F and AUB J C *J Clin Invest*, 1929, 7, 75
 - 3 BODANSKY A and JAFFÉ, H L *J Exper Med*, 1931, 53, 591
 - 4 BODANSKY, M *Texas State J Med* 1934, 30, 218
 - 5 CANTROW, A *Calcium Metabolism and Calcium Therapy* Philadelphia Lea & Febiger 1933
 - 6 CUTHBERTSON, D P and MACKEY, W A *Glasgow M J*, 1935, 123, 249
 - 7 EMGE, L A *Tr Am Gynec Soc*, 1934, 59, 258
 - 8 ENGELBACH, W *Endocrine Medicine* Vol 3 pp 230-232 Baltimore C C Thomas 1932
 - 9 HAMILTON, B *Acta Paediatr*, 1922, 2, 1
 - 10 HANSON, A M *J Am M Ass* 1935, 105, 113
 - 11 HUNTER, D, and AUB J C *Quart J Med* 1926, 20, 123
 - 12 LAMBIE, C G KERMACK, W O and HARVEY, W F *Nature* 1929, 123, 348
 - 13 MCCRUDDEN F H *Endocrinology*, 1922, 4, 734
 - 14 MERRITT, H H, and BAUER W *J Biol Chem*, 1931, 90, 215
 - 15 MULL, J W, and BILL H H *Am J Obst & Gynec*, 1934, 27, 510
 - 16 STANDER H J *William's Obstetrics* 7th ed, p 227 New York D Appleton Century Co 1936
 - 17 THOMSON, D L, and COLLIP, J B *Physiol Rev*, 1932, 12, 309
- Section on Ectosides and Associated Tumors
- 18a BARTSCHER *Monatschr f Geburtsh*, 1861, 18, 121
 - 18b BEHM, F *Monatschr f Geburtsh*, 1854, 4, 12
 - 19 BLACKABY, E J *Brit M J*, 1931, 1, 704



Fig 10 Solitary bone cyst of distal end of the left ulna showing regression of tumor under treatment during pregnancy and puerperium

x ray therapy were delivered anteriorly and posteriorly over the region of the right hip. During the first 8 weeks following the treatment there was relief of pain. On March 14 1934 she returned complaining of pain in the hip associated with some difficulty in the use of the right leg and thigh. Fluoroscopic examination showed no gross deposits in the chest. X ray examination of the hips was done and the coxa vara at the right femoral neck had been increased. A roentgenogram of the lumbosacral spine was made. No abnormality was found but a fetal skeleton was demonstrated. The patient admitted the possibility of pregnancy and stated that her last period had occurred 5 months previously. The patient then visited another city where a therapeutic abortion was done. The consultant being of the opinion that the pregnancy was definitely affecting the progress of the disease. She was seen again May 23 1934. The pain in the hip was increased and in addition some swelling was present in the right hip. Over the hip region 900 r units were administered

and a sterilization dose of roentgen therapy was administered over the pelvis. The patient continued to fail and died one year later from extensive pulmonary metastases.

CASE 10 University Hospital No 52476 The patient white married female aged 30 years was admitted to the University Hospital January 21 1936. The patient states that on or about September or October 1934 she noticed a hard nodule in the upper outer quadrant of the right breast. In February 1935 a radical mastectomy was done. A month after her dismissal she developed a backache in the lumbosacral area which has persisted. On May 24 1935 she had a regular normal period and then a total amenorrhea. About the same time she noted a scabbing of the lower angle of the wound and in September pus began to drain from this area. Examination revealed a recurrence of the original lesion for which she was given deep x ray therapy. In spite of treatment the lesion continued to grow and a few hard masses appeared in the infraclavicular and axillary areas.

The pregnancy developed normally the only difficulty being a rheumatic feeling in the hips and lower back loss of appetite and lassitude. She fell into labor on January 20 1936 and after a 2 hour labor was delivered spontaneously. She was admitted to the University Hospital for care of herself and her premature infant.

The patient was a moderately well nourished female 30 years of age. The face was thin and her cheeks were sunken. The neck was negative. The left breast showed no masses or scar. The right breast had been removed and there was an area of superficial ulceration about 10 by 14 centimeters in size. Small round pea sized nodules were scattered along the line of the incision and the edges of ulcerative areas and larger nodules were in the axillary and infraclavicular areas. Posteriorly in the midscapular line the eighth or ninth rib was enlarged and tender. The lungs were clear the heart was negative. The blood pressure was 118/70. The



Fig 11 Metastatic carcinoma of the right ilium. Anteroposterior study of the pelvis showing irregular destruction of the right ilium

EXPERIMENTAL DUODENAL ULCER

I F VOLINI, M D, H L WIDENHORN, M D, and B H INLAYSON, M D, Chicago, Illinois

THERE have been many references within the past few years to the production of experimental gastro-intestinal ulcers by various methods. The original article of Exalto in 1911 gave the first technique for the almost constant formation of these experimental ulcers by the operation known as "surgical duodenal drainage." This operative procedure consists, first, of severing the proximal and distal ends of the duodenum, these ends are then inverted and closed. A small portion, about $1\frac{1}{2}$ to 2 centimeters of the pyloric part of the stomach, is resected. This pylorotomy is done mainly for technical reasons, as the inversion and closure of the gastric and duodenal opening is easier and safer when the rigid muscular layer of the pylorus is removed. The pyloric end of the stomach and the proximal end of the jejunum are closed separately. The lower distal part of the isolated duodenum is then transplanted to the ascending colon by a lateral anastomosis. Then a gastrojejunostomy is performed, in order to restore the gastro intestinal continuity after the entire duodenal loop with its biliary and pancreatic ducts is isolated. Thus the gastric juice and food are drained into the jejunum while the duodenal secretion with the bile and the pancreatic juice flows directly into the ascending colon.

Mann and Williamson in 1923 varied this technique by inserting the isolated duodenum into the distal ileum. The Exalto and Mann Williamson techniques produce almost 100 per cent of positive ulcers in the jejunum or ileum. Confirmation of these results have been reported by Steinberg, Ivy, Graves, Harper, Dragstedt, McCann, Aron and Weiss, Morton, O'Shaughnessy. The majority of these observers have recorded the finding of acute and subacute ulcers with less frequent observation of the typical chronic gastrojejunal ulcer.

From the Department of Medicine and Surgical Research Department of Loyola University School of Medicine

It is significant that the majority of observers (Steinberg, Haberer, Berg, Graves, Dragstedt, Mann and Williamson) using the operative techniques described lean to the acid peptic digestion theory of ulcer production citing as the experimental evidence the constancy of ulcer formation after the Exalto operation which means the complete exclusion of the duodenum. The duodenum and its secretions, the major ulcer inhibiting factors, are removed from the normal digestive processes. The alkaline duodenal contents are not present to neutralize the acid peptic digestive factor. Ulcer then results from digestion by the acid gastric juice. Acid is the important factor always stressed. Dragstedt showed the protective action of the duodenal secretion in preventing jejunal and ileal ulcers by varying the Exalto Mann operation in the following manner: he transplanted the duodenal loop closer to the gastrojejunal anastomosis implanting the duodenum into the jejunum only 40 to 50 centimeters distant from the ligament of Treitz. Thus the duodenal secretions are in sufficient proximity to the gastrojejunal anastomosis to neutralize the acid gastric juice. He was able to prevent the ulcer formation in 20 of 21 dogs.

Variation in ulcer formation susceptibility for different portions of the gastro-intestinal tract is well known to investigators. The relative resistance of the duodenum is particularly called attention to by many observers and therefore its removal by surgical duodenal drainage is insisted upon for ulcer production in the ileum or jejunum. The deductions from all these experimental evidences naturally give the acid peptic digestion the foremost role in ulcer production. We quote from Dragstedt:

The work of Exalto and of Mann and his associates provided for the first time a method for the regular production of ulcers in the intestines of dogs, without the use of external corrosive agents. Their finding that the diversion of bile and pancreatic juice to the exterior or into the lower ileum would lead to the development of perforating ulcers in that part of the



Fig 1 Dog 6 Specimen obtained at autopsy, after the dog had lived 26 days Exalto operation Few small ulcers in the stomach one large ulcer below the gastro jejunostomy with slightly infiltrated edges of the more chronic type of ulcer



Fig 2 Dog 13 lived 31 days Specimen shows two definite jejunal ulcers below the gastrojejunostomy after Exalto operation

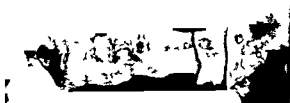


Fig 3 Dog 1 lived 27 days after Exalto operation Specimen shows the isolated duodenum with 6 definite ulcers At the left end are the inverted duodenal stumps



Fig 4 Dog 25 lived 4 days after Exalto operation Specimen shows the gastrojejunostomy with an ulcer on the stomach side one ulcer just below the anastomosis in the jejunum a part of the ileum is put on to it (to save space) showing also an ileal ulcer Below there is the isolated duodenal loop showing the inverted proximal stump and 6 duodenal ulcers



Fig 5 Dog 27 Photomicrograph of duodenal ulcer Loss of mucosa and submucosa is shown



Figs 6 and 7 Dog 27 Higher magnification Absence of mucosa with connective tissue infiltration

small intestine which first receives the gastric content has been amply confirmed. There seems no reason to question the view that it is the neutralizing effect of the alkaline pancreatic juice which normally protects the duodenal mucosa from the acid gastric content.

In a careful study of these various articles we have been unable to find one single reference to the finding of any type of ulcers in the excluded duodenal loop where the Exalto or Mann Williamson technique alone were used.

We now report our observations on 45 experimental animals in which postmortem examination revealed in 28 instances one or more ulcers of the acute, subacute, or chronic type in the transplanted duodenal loop.

The Exalto technique was used in 30 of these animals, the Mann Williamson in 12, and the Dragstedt type of operation in 3. There was no significant variation in the number or character of the duodenal ulcers in the three types of operative procedures. These animals lived from a minimum of 4 to a maximum of 180 days. Some were sacrificed for the postmortem studies while they were still in good condition, while in others the examinations were made shortly after death.

The following description applies to the findings in the isolated duodenal loop ulcers, unless otherwise specifically stated. The ulcers varied in number from 2 to 5. In only 1 instance was only one ulcer found. The ulcerations were principally in two locations: the first site about 2 centimeters from the main pancreatic duct opening, the other on the duodenal side close to the anastomotic opening with the colon or with the ileum. These ulcers were circular or oval in shape, and varied in size from a few millimeters to 1.5 centimeters in diameter. The ulcers were well defined, clear cut, clean in appearance, punched out without undermining, and showed no tendency to perforate, at least within the time limits observed. The tendency to hemorrhage was quite pronounced. In fact, 3 of the animals died from copious hemorrhage from the duodenal ulcerations.

The accompanying photographs of the gross specimen (Figs. 1, 2, 3, 4) illustrate the descriptive features mentioned above.

The microscopic examination reveals the evidence of acute and subacute types of duodenal ulcerations with loss of mucosa, extending occasionally through the submucosa, a surrounding inflammatory zone with a pronounced hyperemia and distention of adjacent blood vessels. Evidence of chronicity was definitely lacking in most of the microscopic sections examined although a tendency to fibrous infiltration was noted, while in a few specimens much connective tissue was evidence of chronic ulceration. The photomicrographs illustrate the microscopic evidence (Figs. 5, 6, 7).

It is to be noted here that most of these animals had, in addition to the duodenal ulcers described, lesions in the jejunum at the anastomosis and just below the anastomosis, and ileum, some of which were of a chronic type. A few animals showed, in addition, gastric ulcerations. These latter findings confirm the earlier observations of the efficacy of the production of experimental gastrointestinal ulcers by the Exalto and Mann Williamson technique.

A control study of the duodenums from 22 apparently normal dogs revealed the presence in 17 animals of circular or elliptical depressions, 2 to 15 millimeters in diameter. These varied in number from 2 to 9. Microscopically these punched out depressions were in every instance covered by intact normal duodenal mucosa, there was no evidence of lymphatic aggregation so that these are not lymph follicles. It is possible that the experimental ulcers described developed at these depressed sites. Bradley, in his recent book *The Topographical Anatomy of the Dog*, makes no mention of such findings in the duodenum. We shall report a larger series with description of the duodenum of the normal dog, with detailed microscopic evidence in order to prevent any confusion that these normal findings are ulcerations.

We find it difficult to explain the reason for the lack of reference in the voluminous literature to the presence of ulcerations in the duodenal loop which we describe as such frequent evidence. No doubt the rather tardy appearance of the upper intestinal ulcers concentrated the attention of investigators,

so that little heed was paid to the examination of the lower bowel and the duodenal transplant. The duodenal ulcers appear soon after the operation and become smaller and less numerous in the longer surviving animals.

Experimentally there are three significant factors in the development of ulcers: first, the mechanical or traumatic factor, second, the susceptibility of the mucosa, and third the chemical factor, free acid plus gastric proteolytic enzymes.

It is difficult to place the etiology of these duodenal ulcers. Is it operative trauma? The same or even greater degree of trauma occurred in the stomach or upper bowel where the ulcer percentage was much lower. The duodenal ulcers appeared in the non-traumatized portion of the duodenum. The vascular supply was not disturbed and no evidence supports this possibility. We furthermore paid particular attention during our operative procedures not to injure the duodenal loop or the pancreas. The food-traumatic factor should be evident, but these findings appeared in animals which had not received solid food and the duodenum on examination did not, in any instance, even in the long surviving animals show the presence of undigested food within its lumen.

The acid digestion of the transplanted duodenum could be the cause of the experimental ulcers. However, the experimental animal shows considerable immunity to duodenal ulcers by any technique. Duodenal ulcers are otherwise very difficult to produce except by direct injection of the duodenal wall by various corroding agents. The alkaline duodenal contents are quoted as being the principal protective mechanism.

The absence of free acid rules usually against ulcer development. The ulcers then would develop on a chemical basis due to a removal of or interference with the normal neutralizing effect of the alkaline duodenal secretions on gastric acidity. Von Haberer found 17 per cent of patients developed jejunal ulcer following gastric jejunotomy when pyloric occlusion was present whereas marginal ulcers occurred in less than 1 per cent when there was no occlusion. Dott and Lim confirmed these findings in experimental

animals. Our animals, however, developed ulcers in the duodenum far removed from gastric acid and gastric contents with the flow of the fluid from the duodenum to the colon rather than vice versa. Charles Mayo claims that 78 per cent of ulcers occur in the duodenum in spite of the alkalinity of the duodenal secretions.

Bile is frequently acid in reaction and not an alkaline secretion. Normally pancreatic juice by reflux through the pylorus probably produces neutralization on the proximal rather than the distal side of the pylorus. These statements presume alkalinity of the duodenal contents. Mann and Bollman report especially in fasting animals very high acid readings of the duodenal content usually temporary in duration. We have confirmed these observations in a few of our animals, practically all those examined showing acid duodenal contents even though the duodenal loop is far removed from the stomach by the operative procedure. These latter findings confuse still further the interpretation of the experimental findings demonstrated in our animals. Until the hydrogen ion concentration determinations were made acid digestion seemed quite remote as an etiological possibility.

The extensive literature on experimental ulcer reveals many methods of ulcer production by the use of bacteria (Rosenow, Turk, Hardt) and toxic and corroding substances (Ivy, O'Shaughnessy, Pavl) by nerve trauma (Cohnheim) by vascular injuries (Klebs, Rolleston, Virchow) and by removal of specific glands such as thyroid (Friedman), adrenals (Widenhorn) and pancreas (Elman and Hartman). Operative procedures of the mutilating and unphysiological character such as the Exalto-Mann-Williamson techniques have been shown to render intestinal ulcers most definitely. Most of the ulcers so produced are of the acute and subacute types and appear soon after the experimental procedure. Our work confirms the fact that the Exalto and the Mann-Williamson procedures are so far as we know today the best and most dependable methods of producing jejunal ulcers in practically 100 per cent of the experiments. We are not able as yet to explain

satisfactorily the etiology of our findings of duodenal ulcers. This work is to be continued and further research by other co-workers is to be stimulated. The production of experimental duodenal ulcers has not been reported in the literature, our findings we believed, warrant this short report.

SUMMARY

1 Two procedures are discussed by which we have been able to produce experimentally jejunal ulcers (a) the Lxalto method, (b) the Mann-Williamson method.

2 Our findings in 45 dog experiments confirm recent reports, that both methods render intestinal ulcers in 100 per cent of the animals.

3 Special attention has been paid to the excluded duodenum, in which we have been able to produce typical acute and subacute and chronic ulcers, varying in size (2 to 15 millimeters) and number. These duodenal ulcers were a frequent finding in 28 of 45 dogs operated upon.

4 Punched out depressions occurring in the duodenum of the normal dog are reported. Grossly these suggest ulcers but the microscopic examination reveals normal intact mucosa.

5 The formation of duodenal ulcers in the experimental animal has not been reported in the literature, as far as it has been available to us.

6 The etiology of these ulcers is discussed without as yet a satisfactory explanation to its possible causes. Trauma should be dismissed as the causative factor.

BIBLIOGRAPHY

- 1 BRADLEY, O. *Topographical Anatomy of the Normal Dog*. New York: Macmillan, 1933.
- 2 ILL, A. C. Physiology of the stomach. *Studies on gastric ulcer*. *Int Med*, 1949, 25, 6.
- 3 JUDD, E. STARR, and WALDRON, G. W. The present status of the surgical treatment of peptic ulcer. *Surg Gynec & Obst*, 1934, 59, 350.
- 4 KAPLAN, R. The experimental production of duodenal ulcer by exclusion of bile from the intestine. *Ann Surg*, 1926, 83, 614.
- 5 MANN and BOLLMAN. Reaction of content of gastro-intestinal tract. *J Am M Ass*, 1930, 95, 1722.
- 6 Idem. Experimentally produced peptic ulcers. *J Am M Ass*, 1932, 99, 1576.
- 7 MANN and WILLIAMSON. Experimental production of peptic ulcer. *Ann Surg*, 1923, 77, 409.
- 8 MATTHEWS, W. B., and DRAGSTEDT, L. P. The etiology of gastric and duodenal ulcer, experimental studies. *Surg Gynec & Obst*, 1932, 55, 265-286.
- 9 MAYO, CHARLES H. Ulcer of the stomach and duodenum. *Surg Clin N America*, 1925, p. 639.
- 10 McCANN, J. C. *Arch Surg*, 1929, 19, 600.
- 11 MORTON, C. B. *Ann Surg*, 1932, 87, 401.
- 12 O'SHAUGHNESSY, L. Etiology of peptic ulcer. *Lancet*, 1931, 1, 177.
- 13 PATRICK, P. T. Reactions of contents of jejunum and experimental production of peptic ulcer. *Arch Surg*, 1935, 30, 557.
- 14 VOLINI, I. F., and McLAUGHLIN, R. F. Histidine mono hydrochloride therapy of gastroduodenal ulcer. *Med Rec*, 1935, 141, 364-366.
- 15 Idem. Histidine therapy gastric ulcer. *Illinois M J*, 1936, 69, 34-45.
- 16 WIDENHORN, H. L. Experimental studies on the pathology of the adrenals. *Arch f Klin Chir*, 1932, 170, No. 3.

CARCINOMA OF THE PANCREAS

JAMES DAVIDSON RIVES B S, M D
FRED MONROE SANDIFER, Jr

SAMUEL A ROMANO, B S M D, and
B A M D, New Orleans, Louisiana

PARTICULARLY during the last few years, when an unusually large number of cases have come under our care, we have been impressed with three things about carcinoma of the pancreas. In the first place, it is relatively frequent, considerably more frequent, in fact, than it is generally supposed to be. In the second place, there is an absence of any reliable criteria of diagnosis except in jaundiced cases. In the third place, the surgeons of this community, ourselves included, are employing for it no method of treatment which offers the slightest prospect of cure.

The classic syndrome of painless jaundice, cachexia, and distention of the gall bladder leads to the suspicion of carcinoma of the pancreas, it is true, but that does not cover the situation. For one thing, by no means all cases involving the head of the gland present this syndrome, and none of the cases in which the body and tail are involved are associated with it. Furthermore, laboratory tests of pancreatic function as an index of the disease have so far been without very great value. Even if they should be so developed in the future that they will prove uniformly reliable, they will continue to be without value until we can establish some clinical picture which will direct our attention to the pancreas and suggest their use.

In the light of these facts, it has seemed to us worth while to study a considerable number of histories in detail, with the hope of ferretting out some symptom or combination of symptoms which might be suggestive of the disease, if not pathognomonic of it. After we began our study from this standpoint, it seemed to us profitable to analyze the whole record and to make such contribution to the problem of carcinoma of the pancreas as we were able to derive from that analysis. We

might add at this point that we made no attempt to review the complete literature of the subject. We did, however, study the largest series of cases of this disease on record in the literature, notably those reported or collected by Fletcher, Eusterman and Wilbur, Kiefer, Friedenwald and Cullen, Leven, Mussey, Ranson, and Speed. These we have used for comparison with our own figures whenever such comparisons were possible and appropriate.

Our investigation, which covers the 10 year period ending December 31, 1935, includes 96 cases selected from the records of Charity Hospital and Touro Infirmary in New Orleans. We use the word "selected" advisedly, for this material represents not more than two thirds of the histories filed as carcinoma of the pancreas during this period in those two hospitals. We accepted only those cases proved by autopsy or supported by the convincing operative findings of competent surgeons. We rejected several cases in which the autopsy protocols were inadequate or contradictory, and we accepted cases in which autopsy was not done only if the surgeon's notes included a satisfactory description of the gross pathology. We also eliminated all cases of islet carcinoma, in which the picture is definitely different, and all cases suspected of being secondary to growths elsewhere.

After these eliminations there remained 96 cases, in 55 of which operation was done without autopsy, in 16 of which both operation and autopsy were done, and in 25 of which only autopsy was done. We are convinced that all of these cases are *bona fide* cases of primary carcinoma of the pancreas.

FREQUENCY

Any conclusions derived from our statistics as to the frequency of carcinoma of the pancreas would be grossly misleading, chiefly because we are quite sure that many actual cases were entirely overlooked or incorrectly ex-

cluded. Such errors undoubtedly prevail in any small series, and we must turn to larger groups of statistics to get any fair idea of the incidence of the disease. The studies of Hoffman and of Leven indicate an incidence of 1 to 2.8 per hundred thousand deaths and an incidence of 1 to 2 per cent of all carcinomas.

AGE, RACE, AND SEX

The patients in our series represented an average age of 58 years, with the range from 25 to 84 years (Table I). The period of greatest frequency was from 50 to 69 years. Sixty-two cases, 65 per cent of the total number, occurred in these two decades, and 88 cases, 92.5 per cent, in the period between 40 and 79 years. These figures are in accord with the large series collected by Leven which includes the 441 cases collected by Kiefer, and they are also in accord with the expected age incidence of cancer in any organ.

There were 78 males and 18 females, a ratio of 4.3 to 1, the male incidence being higher than most other reports indicate. In a total of 872 personal and collected cases (Kiefer, Friedenwald and Cullen, Mussey, Eusterman, Leven, and our own) there were 656 males and 266 females.

Our figures show 69 white and 27 negro patients, a ratio of 2.5 to 1. Discarding the cases from Touro Infirmary, to which institution negroes are not admitted, the ratio is 3 to 2 (68 cases, 41 white and 27 negro). Since the proportion of white to negro admissions in Charity Hospital has been approximately 55 to 45 for the last 10 years, there is evidently a slight preponderance of the disease in white patients. Other observers report that carcinoma of the pancreas is relatively rare in negroes. Futcher, for instance, in a report of 31 cases from Johns Hopkins Hospital, found the ratio 7 to 1, which is at wide variance with our own figures.

PATHOGENESIS

In view of its frequent association with carcinoma of the pancreas it has been suggested (Hulst, quoted by Ewing) that chronic pancreatitis is the actual cause of the malignancy. We are unable to discuss this theory on the basis of our own studies, for the reason that

TABLE I—LOCATION ACCORDING TO AGE, RACE, AND SEX

Age in years	Head	Head and body	Body	Tail	Duct	Total	Per cent age
20-29	2					2	2
30-39	3	1			1	5	5
40-49	8	3	1		3	15	15
50-59	24	4	2	1	2	33	33.4
60-69	17	4	1	6	1	29	30.2
70-79	6	2	1	2		11	11.4
Over 80	1					1	1
Total	61	14	5	9	7	96	
Percentage	63.5	14.6	5.2	9.4	7.3		
Sex							
Male	47	11	4	9	7	78	81.7
Female	14	3	1			18	18.3
Race							
White	46	10	3	5	5	69	71.9
Negro	15	4	2	4	2	27	28.1

in these records the condition of the uninvolved tissue was not usually described. When such information was available, cirrhosis of the gland and dilatation of the ducts were the chief findings, and they point, rather, to the theory that chronic pancreatitis is simply a normal concomitant, so to speak, of the malignancy and not its true cause. Malignant tumors of the pancreas inevitably obstruct the ducts draining a large portion of the gland, and such an obstruction can reasonably be expected to cause fibrosis and other inflammatory changes, while such changes are likewise inevitable in the tissue adjacent to the neoplasm.

Clinical facts support us in our refusal to accept chronic pancreatitis as the cause of pancreatic malignancy. In the first place, the sex incidence is against it. Chronic pancreatitis is commonly supposed to be the result of biliary disease, which in turn is supposed to be about three times as frequent in females as in males. But this series, as we have pointed out, shows a male incidence roughly four times higher than the female incidence. In the second place, the racial incidence is against it. Gall-bladder disease is distinctly unusual in the negro, and particularly in the negro male (Maes and McFetridge, Bloch), while our own figures show no very

TABLE II—LOCATION IN COLLECTED CASES

Author	Total number	Head	Body	Tail	Diffuse
Kiefer*	159	9	12	14	33
Kiefer†	33	24	1	2	4
Leven	127	82	5	16	24
Authors cases	95	7	5	9	7
Total	415	276	25	41	73
Percentage		66	6	10	18

*Collected series
†Personal series

marked racial differences in the incidence of pancreatic malignancy.

Finally if chronic pancreatitis were a frequent forerunner of pancreatic malignancy, we should expect to find in most cases a long standing history of dyspepsia. But such a history was found in only 19 of the 93 cases in which any adequate history was available, and only 9 cases of gall bladder disease were noted in the entire series (7 with stones and 2 without stones). All the probabilities, therefore, seem to be against chronic pancreatitis as a cause of pancreatic malignancy.

PATHOLOGY

Our data were not sufficiently detailed to permit conclusions as to the histological type of growth (whether duct or gland cell carcinoma) and the sections themselves were not usually available for study. We have therefore attempted no consideration of microscopic pathology.

Table II shows the various locations of the malignancy in our series and other reported series and needs no special comment except to emphasize the fact that in 82 cases 83 per cent of the total number the head was involved with or without other parts of the gland. The fact that no cases are recorded as involving the body and tail together can probably be accounted for by the rather vague line of demarcation between the two parts of the gland. Other series show to a greater or less degree the same tendency for the malignancy to involve the head of the pancreas.

METASTASES

In considering metastases in carcinoma of the pancreas we have eliminated from the dis-

TABLE III—SITE OF METASTASES AND REGIONAL SPREAD

Metastases	Total	Per cent	Leven
Total cases	41		99
Liver	29	71	59.0
Regional nodes	14	34.2	50.0
Peritoneum	8	19.5	11.0
Mesentery and omentum	9	21.9	
Lungs	4	9.7	15.0
Pleura	2	5.0	5.0
Heart and pericardium	1	2.4	
Spleen	2	5.0	11.0
Adrenal glands	3	7.5	13.0
Gall bladder	3	7.5	
Involvement of gastro-intestinal tract	5	61.0	

cussion all cases in which autopsy was not done, since the operative findings are necessarily incomplete on this point. No metastases were reported in 43 of 71 operative cases, which, in view of the unhappy end results seems rather too large a number of localized cases to be accepted without grave misgivings. In the 28 operative cases remaining the liver was by far the most frequent site of the metastasis with the glands about the head of the pancreas next and direct infiltration of the stomach, duodenum, and mesentery last.

Table III shows the metastases recorded in 41 cases in our series in which autopsy was done as compared with the proportion recorded in Leven's excellent study of 99 autopsy cases. One or two facts call for brief comment. Only 4 cases showed no metastases. The high proportion of cases in which the liver was involved (29), almost twice the proportion of regional lymph node involvement, leads to the deduction that hepatic involvement must be blood borne. If this deduction be correct, hepatic involvement naturally will occur earlier than lymphatic involvement, and the performance of radical surgery seems a forlorn hope. Eusterman reports that only 52 per cent of the cases handled at the Mayo Clinic showed metastases the order of frequency being the liver, the regional lymph nodes, the peritoneum, the omentum, the pelvic organs, the mesentery, and the stomach. Both Eusterman and

Leven point out that adjacent abdominal viscera are frequently involved by direct infiltration

The gastro intestinal tract was involved in 24 of the 41 autopsy cases, the metastases involving the duodenum in 11 cases, the stomach in 9, the transverse colon in 2, and the descending colon and the small bowel in 1 each. In one case there were multiple areas of involvement. The frequency of duodenal involvement when the original malignancy involved the head of the pancreas (11 of 32 cases) is noteworthy. The lesions which invaded the stomach, on the other hand, were located in all parts of the pancreas. Lesions of both stomach and duodenum, as our clinical study will show, are likely to cause obstruction or hemorrhage or both.

OTHER AUTOPSY FINDINGS

The literature reveals a decided difference of opinion as to the state of the liver in carcinoma of the pancreas. In our own series 28 of the 41 autopsy cases, 51 per cent, were reported to show a palpable liver on physical examination but the actual autopsy findings reduce the figure to 21, in 18 of which the enlargement was due to metastases. The clinical and autopsy findings, furthermore, do not correspond. Only 16 of the 28 clinical reports were confirmed at autopsy, whereas in 6 cases enlargement of the liver which had not been reported clinically was noted at autopsy. We feel safe in saying that the same percentage of error probably runs through the whole series of 96 cases, in which a clinical enlargement of the liver was reported in 61, 65 per cent. We shall have more to say on this subject when the matter of the physical examination is discussed.

Ascites was noted in 18 cases which came to autopsy, but was not a usual finding in the operative cases. It was observed in 48 of Leven's autopsy cases, and in 3 of Kiefer's 33 cases. Ascites is a terminal finding and the figures are naturally likely to disagree if autopsy or terminal figures are compared with the figures for operation, which is presumably done in early or relatively early cases. The explanations advanced for the ascites are variously extrahepatic obstruction (4 cases),

intrahepatic obstruction (5 cases), peritoneal seeding (4 cases), and cirrhosis of the liver (1 case), in 4 cases there was no obvious explanation.

The infrequency of peritoneal seeding in this disease (4 cases) as compared with its frequency in other intra abdominal malignant conditions is remarkable. This finding is mentioned in only 1 operative case, which gives a total of only 5 cases in the whole 96, and we may accept the figures as correct, for it is unlikely that so striking a finding very often escaped attention at operation. Obstruction of the portal vein by extrinsic pressure from enlarged lymph nodes is a theoretic explanation of the ascites, but Boyce's experimental work on stage obstruction of the portal vein, after which ascites did not occur, seems to invalidate that argument.

CLINICAL HISTORY AND SYMPTOMATOLOGY

A discussion of the clinical findings in any disease must properly begin with a discussion of what the late Lord Moynihan first termed "inaugural symptoms." We had hoped to be able to find in these carefully analyzed records some syndrome suggestive of the "inaugural symptoms" of carcinoma of the pancreas, but we regretfully report that we did not. Perhaps this is because the usual routine history is not calculated to bring out the exact character of the patient's earliest complaints. Perhaps internes are not as discriminating in the use of words as they might be—though for that matter, neither are the rank and file of the medical profession, regardless of their greater experience. Whatever the reason, there was nothing in this group of records to furnish us with the syndrome we had hoped to find.

There are in the literature several beautiful descriptions of the symptomatology of carcinoma of the pancreas, the only difficulty being that they usually have no application to the case in hand. In addition to these satisfying literary exercises, there is also a group of hard-dying traditions which have been repeatedly shown to be untrue but which persist, nevertheless, in the consciousness of the average physician. It is still rather generally believed, for instance, that carcinoma of the

pancreas frequently causes diabetes though there is no evidence whatsoever to support this belief. All diseases of the pancreas, again, are by convention associated with girdle pain, though this symptom is almost never noted in carcinoma of the pancreas. Such intestinal disturbances as constipation or diarrhea are usually considered to be present in carcinoma of the pancreas, but if they are, most patients fail to observe them. If frothy or fatty stools are a feature, as many physicians believe, again patients fail to observe them and we must look to the laboratory for proof of their presence. What is more, it must be a better laboratory than the average general hospital boasts, if we are to believe the evidence of our own records and the casual mention of stool changes reported by observers who have really observed their cases carefully.

In short, many descriptions of carcinoma of the pancreas which abound in the literature seem to be based on impressions rather than facts and are not usually supported by a critical study of a representative number of cases. We ourselves feel that reliance on the so called classic picture of the disease can lead only to disaster, and we agree with Eusterman that a combination of symptoms, and a widely various combination at that, is far more in accord with the true facts. Furthermore, if symptoms are not evident enough early enough, or are not definite early enough, for a correct diagnosis to be made, it is almost useless to discuss the matter except for such intellectual satisfaction as the investigator may derive from his effort. Such discussions do not benefit the patient. Delayed diagnosis always means delayed treatment, and delayed treatment in carcinoma of the pancreas seals the patient's doom.

DURATION OF SYMPTOMS BEFORE HOSPITALIZATION

Basing our statistics on the 93 records in which the histories were sufficiently full for analysis, we find an average duration of symptoms before admission of 4.8 months, which agrees closely with Kiefer's estimate of 4.3 months. If we eliminate 5 cases with a history of symptoms for 2 years, the average duration in our series is practically the same for the

various locations of the malignancy (5 months for the head, 4.2 months for the body, 3 months for the tail, and 5.6 months for diffuse lesions). Our suspicion concerning these unusually prolonged histories is that the symptoms of some other abdominal disease, such as chronic cholecystitis, merged imperceptibly into the symptoms of carcinoma of the pancreas. The average duration of life after the onset of symptoms is given by Mayo-Robson (quoted by Leven), Heiberg (quoted by Leven), Leven himself and Friedenwald and Cullen as between 5 and 8 months, which makes it illogical to accept absolutely a 2 year duration of symptoms before treatment. Even if these cases be included, however, there is still no significant difference in the duration of symptoms before treatment for the different locations of the malignancy. The shortest duration was in a case of carcinoma of the head of the gland (1 week), and so also was the longest duration (2 years).

We had thought that since jaundice is a frequent early symptom of carcinoma of the head of the pancreas, patients so affected might apply for treatment earlier than those with less striking symptoms but the figures do not justify this surmise. There was no correlation, furthermore, between the duration of symptoms and the extent of the growth. One patient with diffuse involvement of the gland and extensive metastases had been ill only 2 weeks. Others with smaller, localized lesions told a much longer story. It was discouraging, too, to note at autopsy how many patients with mild symptoms of short duration had lesions which could not possibly have been extirpated. At that, however, autopsy revealed a small number of cases, some 8 in all, in which all gross evidence of the disease might have been removed by surgery, from which we may conclude that in a certain percentage of cases of pancreatic carcinoma there is at least a theoretic possibility of successful operation.

SYMPTOMATOLOGY

The only syndrome that is widely diagnostic of carcinoma of the pancreas is the classical syndrome of Bard and Pic which is supported by Courvoisier's law and which includes cachexia, jaundice, and distention of

TABLE IV.—ANALYSIS OF SYMPTOMS IN RELATION TO JAUNDICE

	With jaundice					Without jaundice					Total
	Head	Body	Tail	Diffuse	Sub total	Head	Body	Tail	Diffuse	Sub total	
Total	66		1	3	72	0	5	6	1	21	93
Pain	43		1	5	54	7	4	6	1	18	72
Dyspepsia present											
Qualitative	33			3	36	4	3	1		8	44
Quantitative	9		1	2	12		1	1		2	14
Dyspepsia in past											
Qualitative	12			2	14		1			1	15
Quantitative	4				4						4
No weight loss	5				5			1		1	6
not stated	24		1	3	28	5	2	1	1	9	37
amount not stated	7				7			1		1	8
under 20 pound	5			2	7	1				1	8
over 20 pounds	25				25	3	3	3		9	34
Nausea and vomiting	31			3	34	5	3	1	1	10	44
Constipation	22			2	24	6	2	2	1	11	35
Diarrhea	4			1	5	1	1			2	7

the gall bladder associated with a liver of normal size. This syndrome, however, concerns only the head of the pancreas and does not necessarily appear *in toto* in any case in that location. Any impartial study, therefore, must begin without preconceived notions as to special syndromes, or the infrequency of any special symptom or group of symptoms. Our own pictures prove that point very clearly. Most of the patients with carcinoma of the head of the pancreas did not have a palpable gall bladder, only 88 per cent had jaundice, and the liver findings showed a very high percentage of clinical error, an enlarged gall bladder frequently being mistaken for an enlarged liver and so invalidating the clinical picture. The most important symptoms of carcinoma of the pancreas in the series which we studied are jaundice (77.4 per cent), pain (77.4 per cent), dyspepsia (62.4 per cent), loss of weight (53.7 per cent), and nausea and vomiting (47.3).

Constipation and diarrhea, which were noted respectively in a third and a fifth of the cases, are no more frequent here, we suspect, than they are in presumably normal individuals of the same age group. Diarrhea was less common than in chronic biliary disease and probably has no value as a diagnostic sign. Pruritis, which we had expected

to be a common complaint in the 72 cases of jaundice, was noted in only 3 cases.

Pain. The general belief that carcinoma of the pancreas, especially when it is associated with jaundice, is a painless condition was not borne out by our figures nor is it borne out by observers elsewhere. Leven notes pain in 100 per cent of his cases, Mussey in 88 per cent, Friedenwald and Cullen in 83 per cent, Fitcher in 58 per cent, and Kiefer in 64 per cent.

Pain occurred in 72 of the 93 cases suitable for study, 77.4 per cent (Table IV), and was relatively more frequent without jaundice (18 of 21 cases, 86 per cent) than it was with jaundice (54 of 72 cases, 75 per cent). It was present in 5 of 6 diffuse lesions, in 4 of 5 cases limited to the body, and in all cases (7) limited to the tail of the gland. On the other hand, of the 75 cases involving the head only 55 (73.3 per cent) were associated with pain on admission. This absence of pain in 20 cases of the latter group cannot be entirely due to the fact that jaundice brought the patients to the hospital before pain developed, for 2 of the 9 patients without jaundice in whom the disease was limited to the head of the gland did not complain of pain on admission. We can only conclude that lesions involving this special area cause pain less frequently than do those

TABLE V — ANALYSIS OF PAIN

Location	Total	Constant dull	Colic like	Constant later colic like	Intermittent non-colic like	Not described
Head	75	27	6	2	6	14
Body	5	2	1		1	1
Tail	7	7				
Diffuse	6	5				
Total	93	41	7	2	7	15
Percentage		44.0	7.5	2.0	7.5	

involving other parts of the gland. As an initial symptom the pain in itself was seldom severe enough to force the patient to seek medical advice.

While no definite conclusions could be drawn from our study of the radiation and location of the pain, some facts are very suggestive. Of 46 patients with pain in the upper abdomen, 19, 41 per cent, complained of radiation to the side or the back. Many authors state that in carcinoma of the body of the gland the pain characteristically radiates to the back or the scapula, but of our 17 cases involving this area, with or without involvement of other areas, only 6, 35 per cent, showed radiation which is practically the same as the incidence of radiation in other areas. In 5 cases in the tail associated with pain radiation is mentioned only once, and in this case, curiously, there was no pain on the left side. Of 3 very extensive lesions only 1 caused radiating pain, while of 34 cases localized in the head of the gland, 12, 35 per cent, were associated with radiating pain, in 1 such case the pain was limited to the back. Obviously, the location of the lesion has little, if anything, to do with the radiation of the pain.

Distention of the gall bladder has been advanced to explain the pain of carcinoma of the pancreas, but we think that the explanation does not hold. The generally dull character of the pain is entirely against that thesis, and the type, we might interpolate at this point, also helps to differentiate carcinoma of the pancreas from such acute upper abdominal conditions as gall bladder disease.

Of 60 patients in this series with distended gall bladders, 44, 70.9 per cent, complained of

TABLE VI — INAUGURAL SYMPTOMS

	Head	Head and body	Body	Tail	Diffuse	Total	Per cent
Number cases	61	14	5	9	7	96	
Pain	34	8	4	7	5	58	60.3
Jaundice	11	5		1	2	19	19.8
Synchronous pain and jaundice	8					8	8.4
Dyspepsia anorexia weight loss	4	1	1	1		7	7.3
Abdominal mass	4					4	4.2

pain while of 31 patients without distended gall bladders, 28, 90.3 per cent, complained of it. To express it differently, while the gall bladder was distended in 61 per cent (44 of 71) of the patients with pain, it was also distended in 76 per cent (16 of 21) of the patients without pain. This seems almost conclusive evidence that in most cases the pain does not originate in the gall bladder. The lower frequency of pain in patients with distended gall bladders (61 per cent against 76 per cent) is probably due to the fact that the disease in most of these cases was limited to the head of the gland, in which area, as we have already shown, pain is by no means as frequent as it is in other locations.

Our own theory is that the pain is probably due to direct infiltration and distention of the pancreas, with blocking of the pancreatic ducts. We do not accept the suggestion of Chauffard and others that it is due to pressure of the malignant mass on the celiac plexus. Severe pain is probably due to infiltration of adjacent viscera or hemorrhage into the gland with pancreatitis, as was observed in 1 case submitted to autopsy. The fact that 5 of the 41 patients submitted to autopsy did not complain of pain is worth comment. 4 of the 5 had no metastases, while in the fifth case only the regional lymph nodes and the liver were involved.

To consider pain as an inaugural symptom (Tables V, VI), some discussion of its association with jaundice is also necessary. Pain was the first symptom in 58 of our cases, 60.3 per cent, and was by far the most general first symptom, jaundice was next, being complained of first in 19 cases, 19.8 per cent.

Eight other patients, 84 per cent, developed pain and jaundice simultaneously, and 18 noted the jaundice within a month after the onset of the pain. We feel quite sure that some of this latter group actually developed pain and jaundice at the same time and simply overlooked the jaundice. We feel it fair, therefore, to combine the figures (19 with jaundice first, 8 with pain and jaundice simultaneously, and 18 with jaundice shortly after the development of the pain), and to say that 45 persons had jaundice with or without pain as one of the first symptoms of their illness. We are supported in this apparent juggling with figures by the fact that while 72 patients revealed a jaundice on physical examination after they had been admitted to the hospital, only 52 of them knew that it was present. We frequently note such ignorance of obvious facts in Charity Hospital, where the color of negro patients obscures such physical findings and where frequently a comparatively low level of intelligence and education introduces other difficulties.

With or without jaundice, however, there is no doubt, from our own analysis, that pain is the most common first symptom of carcinoma of the pancreas. Fitcher notes that it is usually the earliest and most persistent of the various symptoms, but does not comment on its frequency. Kiefer reports it as first in only 4 (13 per cent) of his 33 cases, and other writers ignore this special point.

Jaundice. This finding, as we have already noted, was present in 72 of our 96 cases, 77 per cent. It was present in 71 of the 82 cases involving the head of the gland, 87 per cent, though only 58 of these patients, 81 per cent, had distended gall bladders, which places the 13 others among the exceptions to Courvoisier's law that the gall bladder is distended in malignant disease. It is possible, however, to explain 8 of the 13 cases in which the gall bladder was not distended. In 1 case only the tail of the pancreas was involved and the jaundice was due to inflammatory changes in the gall bladder and bile duct. The 7 other cases involving the head of the pancreas included 2 cases of non-calculous cholecystitis, 4 cases of cholelithiasis, and 1 case of metastasis to the gall bladder. A rather confusing

fact, that of a total of 7 cases associated with cholelithiasis 4 showed grossly distended gall bladders, is probably to be explained by the frequent finding of stones in gall bladders which are not grossly diseased and consequently are capable of distention.

Leven reported jaundice in 77 per cent of his 32 cases, Kiefer in 76 per cent of his 33, Fitcher in 74 per cent of his 31, Friedenwald and Cullen in 78 per cent of their 37, Mussey in 41 per cent of his 90, and Eusterman in 46 per cent of his 48.

Dyspepsia. Fifty-eight patients, 62 per cent, complained of dyspepsia as part of their symptomatology on admission. The fact that in most cases (44) this was of the qualitative type (Table IV) is to be expected, since either jaundice or pancreatic dysfunction is usually accompanied by this variety. Sixty-seven per cent (48) of the patients with jaundice complained of dyspepsia, in 36 cases of the qualitative type, and 48 per cent (10) of the patients without jaundice complained of it, in 8 cases of the qualitative type. In other words, qualitative dyspepsia predominates in about the same proportion, whether or not biliary obstruction exists. The surprising fact is that all patients with carcinoma of the pancreas do not complain of it.

Loss of weight. In 37 cases in this series the matter of weight loss was not noted and it is probably reasonable to assume that this finding was not marked in any of them. In 56 cases some definite statement was made. In 6 cases it was definitely stated that there was no weight loss. In the 50 other cases loss of weight is specifically reported as a symptom. Fitcher reported a marked loss in 29 of 31 cases, Kiefer in 28 of 33, Coller and Winfield in 27 of 30, and Leven in all of his 32 cases.

The loss in pounds is always considerable. In 8 of our cases the amount was not stated, but in 8 cases it was less than 20 pounds and in 34 it was more than that amount. Kiefer reports an average loss of 28 pounds, Fitcher of 32, Mussey of 26, Eusterman of 29, and Keeton losses up to 80 pounds.

It had seemed to us that the anorexia and intestinal indigestion associated with jaundice might be a major factor in the loss of weight, but the facts do not bear it out. Thirty-nine

(54 per cent) of the jaundiced patients reported a loss of weight, but 11 (52 per cent) of the patients without jaundice exhibited the same symptom. As the percentage could be scarcely more nearly the same, our hypothesis must be abandoned. Furthermore, only 35 per cent of the jaundiced patients had lost 20 pounds or more, against 42 per cent of the non jaundiced patients with this weight loss. It might be suspected from the literature that failure of the extrinsic secretion of the pancreas to reach the intestinal tract because of obstruction of the duct of Wirsung might be a major factor in the loss of weight, but since jaundiced patients are the ones most likely to exhibit such an obstruction, our figures are against that hypothesis also.

Nausea and vomiting. The incidence of nausea and vomiting in other reported series ranges from the 32 per cent reported by Fitcher to the 89 per cent reported by Friedenwald and Cullen. It was present in 44 of our cases, 47.3 per cent. We had considered that its frequency might be due to biliary obstruction, but the records show that 47 per cent of the patients with jaundice (34 of 72) complained of this symptom against 48 per cent (10 of 21) without jaundice. We must look elsewhere therefore, for the cause. A reasonable explanation seems to lie in direct involvement of the gastro intestinal tract or direct involvement of the pancreas itself. Of the 44 patients who complained of this symptom 15 showed either direct involvement of the stomach, duodenum, and jejunum, or partial obstruction of these structures by extrinsic pressure. On the other hand, since 53 per cent (34) of the patients with biliary obstruction had no nausea, and since 66 per cent (29) of those who complained of nausea had no invasion or obstruction of the intestinal tract neither jaundice nor gastro intestinal involvement offers a reasonable explanation for this symptom, and the important cause is probably direct involvement of the pancreas itself.

Hemorrhage. In view of the high incidence of jaundice in this series it seemed reasonable to expect that hemorrhages of various sorts would be quite frequent. Actually, however,

only 5 jaundiced patients exhibited bleeding as a symptom, in one of this group the hemorrhage was due to invasion of the gastro intestinal tract. Only 4 jaundiced patients, furthermore, died of postoperative hemorrhage. Even if we add to these 9 jaundiced patients, 4 non jaundiced patients whose bleeding was due to invasion of the gastro intestinal tract, the total figures for hemorrhage are by no means impressive.

The infrequency of hemorrhage in carcinoma of the pancreas in jaundiced patients parallels the finding of Boyce, Veal, and McFetridge in their analysis of the causes of death after biliary surgery in Charity Hospital. They have no explanation to offer for so striking a variation from the usual figures for hemorrhage in jaundiced patients with cholecystic disease, but it seems a curious coincidence that in our own series dealing with jaundice of a different origin very much the same situation should prevail.

PHYSICAL EXAMINATION

With the exception of diseases of the female pelvis, physical examination is usually unreliable in the diagnosis of neoplastic diseases within the abdomen, and carcinoma of the pancreas is no exception. On the other hand, in a considerable number of cases such an examination does give definite evidence of serious upper abdominal disease, as we shall point out shortly, and when analyzed in connection with the clinical history, it should lead to the appropriate laboratory investigations and should turn one's mind to exploratory operation if such tests do not clear up the situation.

Friedenwald and Cullen noted abdominal masses, excluding palpable gall bladders in 16 of their 37 cases. Kiefer in 9 of 33 and Fitcher in 12 of 21. The primary tumor is probably rarely felt, and metastatic masses in the liver and other viscera, together with the dilated gall bladder, make up the tumors usually felt. Table VII shows the classification of the abdominal masses recorded in our own series. They were palpated in 51 of the 96 cases, but operative and autopsy evidence proves that in a large proportion of cases probably the majority, the supposed tumor

mass was not the malignant tumor but the liver or the enlarged gall bladder

Twenty-eight of the 41 cases which came to autopsy, 51 per cent, exhibited clinically, as we have already pointed out, a palpable liver, but the autopsy findings reduce the figure to 21 per cent. Furthermore, only 16 of the 28 clinical reports were confirmed at autopsy, whereas in 6 cases enlargement of the liver was noted at autopsy which had not been reported clinically. These errors are so significant that we believe the repetition of these facts is warranted at this point. Coller and Winfield report the liver palpable in two-thirds of their cases, Leven reports it palpable in 81 per cent, and Kiefer, Fletcher, and Friedenwald and Cullen report percentages varying from 57 to 80 per cent. None of these authors, however, states in how many cases the clinical finding was confirmed by operation or autopsy.

The errors noted in palpation of the liver seem to have been perpetrated also in the examination of the gall bladder. Only 27 palpable gall bladders were reported in the records, against 60 grossly distended organs found at operation or autopsy. In a few cases the distention was not marked and the gall bladder perhaps really could not be palpated, but this does not hold true in most cases, as is proved by the repeated use of such words as "enormous" and "tremendous."

Physical examinations recorded in other series seem to be considerably more accurate. Leven reports palpable gall bladders in 14 of 20 jaundiced cases, all confirmed by operation or autopsy. Kiefer was able to palpate 15 of 17 distended gall bladders, and Friedenwald and Cullen 23 of 37. Mussey found palpable organs in 31 of 37 jaundiced patients, and Eusterman mentions 50 per cent palpable in his series.

Tenderness was noted in 51 of our cases, 54.8 per cent, but was without very striking characteristics. The location usually corresponded with the location of the pain. Ranson mentions tenderness in "most" of his cases, Friedenwald and Cullen in 70 per cent, and Leven in 66 per cent.

Jaundice has been sufficiently discussed elsewhere to need no repetition, and we have

TABLE VII—PHYSICAL FINDINGS

	Head	Head and body	Body	Tail	Diffuse	Total
Total cases	61	14	5	7	6	93
Jaundice	53	11		2	6	72
Enlarged liver	44	7	1	4	5	61
Tumor	31	10	2	6	2	51
Tenderness	33	7	3	3	5	51
Palpable gall bladder	20	6			1	27
Ascites	8	1	2		2	13
Edema	2		1			3

also mentioned ascites as being an infrequent and terminal state. A slow pulse is very generally regarded as characteristic of jaundice, but we did not find a single instance of brachycardia among our 72 jaundiced patients.

Considering these various findings from the standpoint of diagnosis, it may be said that the patients with palpable tumors and the patients whose first symptoms were loss of weight, anorexia, and dyspepsia, probably were all at the stage where nothing could be done to help them. Their disease was far advanced before they had reason to suspect its existence, and Gordon-Taylor's unique report of an 8 year cure in such a case does not alter the hopelessness of the general picture.

From the standpoint of the physician such patients appear with their diagnosis already made. The patients with pain and jaundice would be suspected of having some serious pathological state in the biliary tract and pancreas, as would the patients who present jaundice as their first symptom. In the hands of a competent practitioner they would be subjected to prompt exploration, on suspicion if no definite diagnosis could be made. A reasonable number of such patients, we may assume, would have localized lesions, perhaps suitable for extirpation by the method of Whipple, Parsons, and Mullins. The patients with the single complaint of pain form a more perplexing group. In such cases the discomfort is seldom very severe and has no special characteristics pointing to its origin, though perhaps more careful questioning might shed a good deal of light on the matter. We have promised ourselves to be considerably more careful in this regard in the future.

LABORATORY STUDIES

The resources of the laboratory were perhaps not as fully utilized in this series as they should have been, which leads to the natural suspicion that the true character of the lesion was frequently not suspected. Pancreatic function tests, in particular, were not used often enough to permit us to draw any conclusions at all concerning their value. Perhaps they were so little employed because the reports in the literature offer so little hope from them.

Stool examinations were fairly frequent, but the results, except for the absence of bile in jaundiced patients, were uniformly negative. The bulky, fermenting, and putrefying stools repeatedly mentioned as characteristic of carcinoma of the pancreas were not found, nor was a high fatty content noted in any case in which such a study was made. Friedenwald and Cullen, Kiefer, and Fletcher report such findings as the exception rather than the rule, and we believe that both of these supposed facts are entirely supposititious. We are supported in our belief that stools of a high fatty content are not characteristic of carcinoma of the pancreas by the recent report of Whipple, Parsons and Mullins, dealing with the ability of the small intestine to take over the digestive function of the pancreas after resection of the gland. We are further supported by the (unpublished) data of F. F. Boyce on the subject of fat digestion after ligation of both pancreatic ducts and large resections of the pancreas. Even with diets far above the average in fat content he could not produce fatty stools.

The urine showed little worthy of comment. Jaundiced patients showed the usual finding of bile, but glycosuria was noted in only 2 patients, both with elevated blood sugars, one of whom had a history strongly suggestive of an antecedent diabetes. Glycosuria is not a typical finding in carcinoma of the pancreas. Pearce and Eusterman found it in only a small number of their cases, less than 10 per cent. Friedenwald and Cullen noted it in only 16 per cent, Kiefer found it in only 43 of 251 collected cases, and Leven found it in only 3 of 32 patients, 2 of the 3 having a previous history of diabetes.

Nine patients, including the 2 patients previously mentioned as having glycosuria exhibited a blood sugar above 120 milligrams. In only 2 cases, however, was the tail of the gland involved, and it seems fair to say that the relation of the elevated blood sugar to the neoplasm is very questionable. Certainly the obstinate fiction that carcinoma of the pancreas frequently causes diabetes is not supported by our figures, nor has it ever been supported by substantial evidence or informed opinion.

Eighteen of 49 patients examined (36 per cent) exhibited a leucocytosis, and it is worthy of note in this connection that fever was equally common. It is important to remember, therefore, that when the diagnosis lies between inflammatory and neoplastic disease of the pancreas, the presence of neither fever nor leucocytosis can be depended upon to eliminate malignancy.

The icteric index, gastric analysis, and blood studies offered no information pointing to the diagnosis of carcinoma of the pancreas. On the other hand, the information supplied by the x ray, which was used in 50 cases, was frankly very surprising to us. Because of the differences in the manner of approach to the problem, these 50 cases must be considered in 2 groups.

Forty cases were studied by Dr. Amedee Granger and his associates at Charity Hospital. This group attaches great importance to the evidence of extrinsic pressure on the gastro intestinal tract, and even more importance to the widening of the duodenal loop. On this basis they made a correct diagnosis in 17 cases, 40 per cent of the total number studied, though naturally we have no way of knowing in how many other cases the diagnosis was made incorrectly, on the basis of the same finding. In spite of this possibility, however, we are decidedly impressed with their frequency of correct diagnosis.

Drs. Henderson and Rodick, who studied 10 cases at Touro Infirmary, concentrate their attention on extrinsic pressure and actual narrowing of the lumen of the stomach and duodenum, without attempting to identify the cause of the deformities noted. On this basis they noted partial obstruction of

the duodenum in 4 cases (3 in the second portion and 1 not stated), and extrinsic pressure in 2 (1 on the duodenal bulb and 1 on the pylorus). Sixty per cent of their cases, therefore, showed definite evidence of organic disease in the region of the body and head of the pancreas.

Turning to the literature, we find Speed reporting only 2 positive x-ray diagnoses in 23 cases, Leven 6 in 24, and Kiefer none in 13 cases. On the other hand, we have in 50 cases in our series positive or definitely suggestive findings in 23, 48 per cent. Certainly no other method of diagnosis seems to offer so much promise, and the percentage of correct diagnoses will probably be materially improved as the method begins to be more widely used.

THERAPY

The results of treatment by the methods employed in this series form a melancholy picture, and the poor results are substantiated by statistics from most other clinics. Twenty-five of our 71 surgical patients died in the hospital and are promptly eliminated from the discussion. Of the 46 remaining, we have been able to secure a follow-up note on only 20, all of whom were dead at the end of 8 months, and 50 per cent of whom were dead within 3 months. Furthermore, while our information is too slight for definite statements, we may say that we were not impressed in any case with any very marked relief of symptoms after surgical treatment.

In view of this picture, only two factors would seem to make it worth while to carry the procedure beyond simple exploration, which, in itself, results in a definite mortality, though it is the only course open in many cases to make the diagnosis at all. The first reason for operation, other than exploration, is that the diagnosis may be erroneous and that biliary obstruction, which dominates the picture, may be due to some benign lesion such as pancreatitis, stricture of the duct, or unrecognized stone in the common duct. The second reason is that the relief of jaundice by anastomosis of the gall bladder to some part of the intestinal tract may produce some transient clinical improvement in the symptoms due to jaundice. On the other hand, judging

by our own statistics, jaundice seems to play so small a part in the incidence and severity of the various symptoms that we should expect little benefit from such a procedure.

Radical resection of the pancreas for cancer has not often been attempted, because of the serious technical and anatomical difficulties involved. Whipple and his associates seem to have solved the problem of radical resection of the head of the gland, and although the operation they propose is a very formidable one, it seems fully justified by the inevitably rapid and fatal course of the disease when it is untreated.

The tail of the gland has been removed many times for benign lesions, and the technique is well described by Clute in a discussion of carcinoma of the pancreas. We cannot agree with him, however, that this procedure is adequate for malignant disease. It does not include regional removal of the lymphatics extending from the tail of the pancreas along both the upper and lower borders of the gland and beneath it into the hilum of the spleen, from which point they lead to the gastrosplenic omentum and follow the gastrosplenic vessels toward the pylorus. We have seen at autopsy definite metastases along this lymphatic chain. For this reason we insist that any operation for cancer in the tail of the gland must include the following steps: removal of the spleen with its vessels as far as the resection of the pancreas is to extend, removal of the splenic ligaments as close to the stomach as possible, removal of the entire gastrosplenic omentum, including the gastrosplenic vessels. By such a procedure the lymphatic trunks which lead from the tail of the pancreas to the spleen are removed, as well as those which follow the gland itself toward the pancreaticoduodenal and aortic lymph nodes.

It remains to mention in conclusion the operation described by Gordon-Taylor and performed by him in a single case, which resulted in a spectacular cure, lasting 8 years when he made his report. Whether it could be duplicated is another question. The author himself notes that it required a combination of extreme daring and unusual good luck. The malignancy in this case involved the body

PACKING GAUZE DRAINAGE AFTER PNEUMONECTOMY

Dr JOSÉ ARCE, Buenos Aires Argentina

DURING recent years, my experience in lung surgery has increased considerably. Some time ago opening the pleura was a rather exceptional procedure, and approach to the lung was only a step in the process of the eradication of hydatid cysts. Now, however, we often have the opportunity of exploring the lung in cases of bronchiectasis, cancer, and foreign bodies. If hydatid cysts are eliminated we find that cancer is the next most frequent condition that calls for surgical treatment. More than a dozen times I have had to deal with this serious condition. In some of the cases I have simply explored the region without further attempt at removal, because the cancerous lesion was so extensive that it was inoperable. In other cases I have performed a total pneumonectomy, but without success as my patients died within 24 hours to 8 days after operation. Both my assistants, Drs Ivanisovich and Ferrari, have performed total pneumonectomy for cancer, but they too have had untoward results. Such failures may be explained by the facts that the patients were in very bad condition as a result of the advanced stage of the disease, that they came for treatment late, that the operation itself may cause respiratory and circulatory distress, and also it should be kept in mind that infection easily establishes itself in the pleural cavity.

Fortunately, our results have improved during the past year. I have had the opportunity of saving the lives of two patients: one, a boy of 12, and the other, a woman of 29 years, were subjected to total pneumonectomy of the right and the left lung, respectively.

In these operations I did not follow the general technical procedure, and I shall attempt here to present a brief description of my method.

In the first case pneumonectomy was performed for the treatment of congenital bron-

chiectasis with several cavities present in the right upper and middle pulmonary lobes. When first admitted to the hospital, the boy had an abscess of the upper right lobe as a result of the infection arising from one of these cavities. One of my assistants, Dr Ivanisovich, in charge of my service at that time, opened and drained the abscess, and in 2 months, the wound was healed. X-ray examination, however, revealed that the cavities still persisted and that there was free communication with the bronchi—possibly a recurrence of the infection with all its sequelae. It was quite logical to consider, without further intervention, that some other disease, such as tuberculosis or amyloid degeneration, might be developing. I therefore advised performing a pneumonectomy at once. The operation was difficult only when I severed the adhesions present between the upper lobe and the chest wall, in the field of the former operation, I noticed that it was bleeding severely here, and it was impossible to control the hemorrhage except by packing.

I decided to pack the entire cavity with gauze to make sure that the ligature that I tied in the pedicle would not slip as sometimes happens and to prevent the formation of a fistula that sometimes is seen in such cases. The packing fitted the thoracic cavity tightly and I covered the stump left at the pedicle with iodoform gauze.

By means of 6 big compresses I was able to control the hemorrhage. Another large compress placed between the others over the lung stump, compressed the mediastinum.

The after result was excellent, 2 days after operation, the boy was normal, and 15 days later I removed the 7 compresses used for packing. I was amazed to discover a funnel-like cavity, clean, uniform, even covered with very healthy looking granulation tissue. The costodiaphragmatic sinus, filled with the granulating tissue, had already disappeared, so that the stump was entirely covered and it was impossible to see the silk ligature which

I had left in the pedicle. The wound was in excellent condition and healed quickly and completely.

A complete report of this case with illustrations will soon be published in another journal. The success obtained encouraged me again to use the "packing drainage" in other cases.

Last September, I operated upon a woman who had a metastatic carcinoma of the lung after the removal 6 months previously of a nevus carcinoma of the face. The operation was performed without difficulty and after the extirpation of the left lung, in the upper lobe of which near the hilus the tumor was located, I inserted into the empty left thoracic cavity a packing similar to that described, consisting of 6 compresses. I left free only the pedicle over which I placed very tightly a large compress of iodoform gauze. Each of the compresses measured about 1 square meter in surface.

The postoperative course was uneventful, the day after operation the patient appeared like one who had had an appendicectomy, convalescence was without incident. Fifteen days after operation, the compresses were removed, and the operative wound was found to be in good condition. In the anterior part of the cavity, the beating of the heart was apparent through the pericardium and the layer of granulating tissue that covered it. Three weeks after operation the wound was greatly reduced in size, and the patient, who had been getting out of bed, was feeling fine.

Can we say that the packing was helpful in bringing about recovery in these 2 cases after total pneumonectomy? I believe that it did have considerable influence in bringing about the favorable outcome and the good condition of the patient immediately after operation. The open wound, well packed, held in check any pleural infection, and there was no further possible reabsorption of toxic material. These two advantages insure a good chance of recovery.

How can we explain the influence the packing drainage had upon the favorable results?

1. The packing drainage filled the hemithoracic cavity, just as a Mikulicz's drain fills the pelvis, thus preventing the retention of liquids that may become more or less septic

and cause pleural infection. Gauze packing is much better than rubber tube drainage.

2. Packing drainage in itself acts as a support to the mediastinal organs, thus preventing displacement and insuring good function of the remaining lung. Normally, there is a balance between the two halves of the thorax, because both are filled. If we take out one of the lungs, however, and we leave the thoracic cavity empty, we create a sudden pneumothorax, just as is present in case of injury or the surgical opening of the thorax. The mediastinum is then displaced all the way to the opposite side during the inspiration and toward the diseased side during expiration. This displacement interferes with inspiration as well as with expiration. This does not happen with closed pneumothorax because the positive pressure produced by the air injection into the pleura prevents the displacement of the mediastinum as in the case of an artificial pneumothorax and also of the preliminary pneumothorax that I was the first to introduce into the practice of thoracic surgery.

After pneumonectomy if the thoracic cavity is left empty, the physiological and pathological conditions of open pneumothorax are quickly established, but if the cavity is filled tightly with a gauze packing, we prevent displacement of the mediastinum and the remaining lung will have normal support for its function. The heart will work much better and the equilibrium of function will be soon established.

3. After pneumonectomy, healing begins in the stump, and the healing tends to obliterate the blood vessels and the severed bronchi. The pulmonary artery and veins are ligated very close to the heart, and it may be possible that the clots that develop back of the ligature may advance toward the cavities of the heart and produce some very dangerous form of thrombosis. Perhaps by keeping the organs in place, the packing drainage helps to prevent any possible displacement of the clot and favors the quick complete obliteration of the ligated vessels.

The success that I have had in these 2 cases of pneumonectomy may have led me to explain the results on a mere hypothetical basis, and there may be some other more

accurate explanation of the facts I believe, however, that at least the first two items in my conclusions are borne out by the facts.

No matter what the explanation may be, the results speak for themselves and are more

important than theories. If my colleagues accept my theories, I will have still further reason to continue the use of packing drainage after pneumonectomy in order to help patients after the removal of a diseased lung.

FURTHER STUDY OF BLOOD IODINE CHANGES IN AFFECTIONS OF THE GALL BLADDER

JOSEPH L. DECOURCY, M.D., F.A.C.S., Cincinnati, Ohio

THE importance of being able to estimate the amount of iodine in the blood, both in normal and pathological conditions is now well recognized. For the past 15 years efforts have been made to establish standards of technique whereby such estimations could be made quickly, easily, and accurately.

Progress has been made but much still remains to be accomplished. We are now able, however, to make these estimations with sufficient exactness to be of great value in clinical practice. Used at first only in thyroid diseases, the test for blood iodine has shown its usefulness in the diagnosis of numerous other conditions (Perlin, Lahey, and Cattell).

At the writer's clinic the test was made originally upon goiter patients only. More recently its application has been extended so as to become a part of the routine general examination. Our attention to this wider usefulness of the test was attracted when we set out to arrive at a normal standard of blood iodine for the geographical region within one hundred miles of Cincinnati. In this endeavor we made some two hundred determinations upon residents in this area coming under our care. These were patients suffering from a wide variety of affections many in no way connected with thyroid derangement. Among them were some cases of acute cholecystitis and also of chronic cholecystitis and liver deficiency.

In a previous report (3) of blood iodine studies in cholelithic disease, I concluded that such determinations might be a better test of

liver function in cholecystitis of long standing than the dye tests in general use, especially since iodine is a normal constituent of blood. With the knowledge afforded by such a test many cases of "liver death" could be avoided by administering glucose before operation to gall bladder patients showing high blood iodine values.

The present communication is an amplification of these earlier studies. It was noted that a high iodine content of the blood was invariable in the acute cholecystitis cases, much above the 3 to 6 gamma per 100 cubic centimeters which our researches and tests had shown to be normal for our section of the country. In chronic cholecystitis with stones, an average of 20 cases proved to be 16.6 in the chronic condition with stone in the common duct it was 20.0. Four cases of hydrops of the gall bladder gave an average of 15.6, while carcinoma of the liver showed 6.0 for 3 cases. These results pointed strongly to the liver as a potent factor in the regulation of blood iodine.

Further researches together with a large number of clinical observations, served to confirm this opinion. In obstructive jaundice the blood iodine was regularly very high. In cholecystitis and hepatitis also the figures rose far above normal. But the blood iodine remained normal in cases of advanced cirrhosis of the liver—a finding which we were at a loss to correlate with any of the other data which we obtained. The relationship between the liver and the thyroid gland—source of the body's iodine supply—is being widely investigated (Rpetto, Doetsch).

TABLE II—COMMON DUCT LIGATION—
RABBIT 2

Day	Food iodine (gammas)	Fecal iodine (gammas)	Urinary iodine (gammas)	Blood iodine (gammas per 100 c. cm. B)
1*	12.6			
2	0		No urine	5.9
3	0		Lost	
4†	2.7	No feces	5.0	
5	0.8		Lost	
6	0		5.4	
7	0	11.6	5.9	32.4

*No blood counts were taken
†Operated upon
Died 9:30 a.m.

and clinical, which seem to give added confirmation to what we had ourselves witnessed, we decided to undertake some animal experiments with the hope of adducing additional data on a subject which remains persistently obscure. Three rabbits were employed, one being retained as a control while the other two were subjected to operation. Tables are appended which show the facts sought and the data which were secured.

The iodine content of the daily intake of food is expressed in gammas for each successive day. It will be noted that the iodine elimination in urine and feces is likewise recorded for each day. It should be mentioned, however, that inability to prevent contamination of the urine makes these data more or less untrustworthy. Allowance must be made for this fact. The iodine content of the urine has been demonstrated to vary with the kind of food ingested, the time of day, state of the weather, age of the subject, etc. while the iodine content of the blood remains relatively unaffected by such external conditions (Curtis).

In Table I for control rabbit, Rabbit 1, it will be noted that the blood iodine never went above 17.5 gamma even when the iodine constituents of the food raised the intake to 226 gamma and maintained it at that level for three successive days. These figures were obtained on the basis of a normal iodine content of the blood being 4.4 gamma.

Rabbit 2 was subjected to common duct ligation, after having been under preliminary observation for a time sufficient to establish

its normality at the outset of the experiment. Silk suture material was employed in the ligation. Estimation of the blood iodine on the third day following common duct ligation showed it to have risen to 31.4 gamma. The blood counts on succeeding days, as well as the date of the appearance of jaundice, are noted.

Rabbit 3 was likewise subjected to common duct ligation and, in addition on the third day thereafter, to division of the duct. The animal remained under close observation for 27 days thereafter. During this time the food of this rabbit and of control Rabbit 1 was precisely the same, yet in Rabbit 3 the blood iodine rose to a high point of 227 gamma and was 224 on the same day that of Rabbit 1 was but 14.5. Just before death, on the twenty-sixth postoperative day, the blood iodine fell to 62 gamma.

These experiments together with clinical observations made during more than 2 years have convinced us that the liver plays a very important part in the maintenance of a normal blood iodine, irrespective of the kind or amount of food ingested.

EVALUATION OF STUDY

In considering these findings the question naturally arises: What part of the liver is concerned in the retention of iodine in the blood? This question still awaits an answer, but it is our impression that the Kupffer cells, which are the hepatic representatives of the reticulo endothelial system, play a leading role in this mechanism.

In the parenchyma of the liver there are two chief types of cell, i.e. the hepatic cells and less numerous and important the stellate cells of Kupffer. "These cells," to quote Mann, "are ordinarily now considered as not pertaining ontogenetically to the hepatic organization, but rather to the system of macrophages which abound elsewhere in the body." Kupffer cells were originally considered a part of the endothelium of the hepatic lobule and were often designated as specialized endothelial cells. {but} it is far more likely that definitely organized endothelium does not exist within the hepatic lobule, but that a syncytial membrane, to-

TABLE III—COMMON DUCT LIGATION FOLLOWED BY DIVISION OF DUCT—RABBIT 3

Day	Food iodine (gammas)	Fecal iodine (gammas)	Urinary iodine (gammas)	Blood iodine (gammas per 100 c. cm.)
1	10 7			
2	3 4		No urine	4 4
3*	0		No urine	
4	2 6	no feces	Lost	
5	6 8	no feces	No urine	
6	2 6		216	
7	4 9	7 5	4 5	
8†	3 8		No urine	
9	3 4		350	
10	5 5			
11	5 6		No urine	
12†	4 4			
13	3 4		3 7	
14†	6 0		249	4 6
15	5 1			
16	5 1		583	
17†	8 3		608	
18	10 8		121	
19†	10 8			
20	216		158	
21	222			227
22	222			
23†	10 2			224
24	14 2			108
25	7 7			
26	15 4			
27				62
28				
29				
30‡				

*Operated upon
†Jaundice first noted
‡Died 9-15 a.m.

BLOOD COUNT			
8th Day			
RBC	5 213 000	Polys	16%
WBC	12 700	Lymphos	75%
		L. monos	4%
		Baso	4%
		Eosin	4%
		Stabs	12%
12th Day			
RBC	6 800 000	Nucleated RBC	5
WBC	10 800	Stuppled RBC about	200
Polys	61%		
Lymphos	10%		
L. monos	9%		
Baso	10%		
Stabs	2%		
Shift	8%		
10th Day			
RBC	5 140 000		
WBC	17 150		
Polys	43%		
Lymphos	41%		
L. monos			
Eosin			

gether with reticular fibers, separates the hepatic parenchyma from the intralobular capillaries, so that in reality body fluids of the vascular system actually bathe the parenchyma cells as they circulate through the hepatic lobule Phagocytosis characterizes the functionally active Kupffer cell It seems clear the Kupffer cells of the liver are a part of the changing system of histiocytes or macrophages which have been designated the reticulo-endothelial system "

Accepting Mann's conclusions as to the Kupffer cells' nature and function, it is not unreasonable to assume that their physiological activity may have an even further reaching effect than this assumption includes As far back as 1928, Jaffe and Berman, of the University of Illinois Medical School, demonstrated that these cells are largely concerned in the metabolism of fat In the course of their experiments rabbits were thyroidectomized and injected with fat droplets The results showed that lack of the thyroid interferes with the quick elimination of the fat droplets through the liver These observations clearly point to activity of the reticulo-endothelial system of the liver in the regulation of blood iodine, even though research has not yet been far enough extended to produce positive proof

Some of the autopsy reports upon patients who died in the "liver death" syndrome are of interest in this connection Heuer speaks of the "quite consistently striking degenerative changes in the liver and kidneys The liver showed leucocytic infiltration, necrosis, and interstitial hemorrhages, or marked parenchymatous and fatty changes, most marked about the gall-bladder fossa " Schutz and his co-workers found "either leucocytic infiltrations, necrosis, and interstitial hemorrhages, or marked parenchymatous and fatty changes " And "in all instances in which gall-bladder disease was the reason for surgical intervention," these authors obtained "a history of long standing cholecystitis and, at both the operation and the necropsy, liver

Baso	9%	varied slightly in size and shape	Lymphos	31%	
Transitional	1%		L. monos	5%	
Stabs	6%		Baso	11%	
Shift	16%	27th Day	Stabs	8%	
Nucleated RBC	17	RBC	5 360 000	Shift	15%
Stuppled RBC	44	WBC	16 350	Nucleated RBC	1
Polychromasia RBC		Polys	33%	Stuppled RBC	

SURGERY, GYNECOLOGY AND OBSTETRICS

TABLE II — BLOOD IODINE¹ BEFORE OPERATION

No.	Date	Gamma 1-20 cent.	Diagnosis
10	0-11	c	4 Nodular colloid, goiter
11	0-1	c	4 Neurosarcoma
1	0-13	11	4 Toxic nodular colloid.
	- 8-	c	4 Toxic adenoma
	1-1		Tumor of pancreas
1	-1	4	4 Toxic adenoma of thyroid.
	0-		- Adenoma
1	-1	4	4 Toxic adenoma
	-		- Hyperthyroid
	- 1	1	0 Thyroiditis
	-	4	4 Abnormalities of thyroid
1	1		Operative procedure for 1 month ago
	-		Nodular colloid
	-	4	4 No diagnosis given
1	1		No diagnosis given
	-	4	4 Fibroid cervix
	-		No nod. colloid given previously operated
	0		Nodular colloid
1	-	4	4 Hyperthyroid, extrathyroidal
	-		- Nodular colloid
	-	c	4 Nodular colloid "typical"
1	-		Adenomatous thyroid and hemorrhoids
	-		Hypertension
	-		Hyperthyroid, has been taking Lugol's
	-	0	0 Diffuse nodular colloid
	-		Adenoma of thyroid
	-		Nodular colloid adenoma
	-		No diagnosis given
	-	4	4 Hyperthyroidism
	-		Nodular colloid goiter
	-		No diagnosis given
41	-1		Cancer of uterus
42	-		Chronic cholecystitis, possible cancer of liver
43	-1		Hyperthyroidism
44	-1		Adenoma of thyroid
45	-1-0		Hyperthyroidism
46	-1-0	c	4 Nodular colloid goiter
4	-0-1	1	0 Colloid goiter possible gall stones
45	-0-1	c	Hyperthyroid goiter
-0	-0-1	1	0 Acute hydrops of gall bladder
0	-0-1		Hyperthyroidism

The results on patients

who have been operated on are not reliable

TABLE II — BLOOD IODINE BEFORE OPERATION—Continued

No.	Date	Gamma 1-20 cent.	Diagnosis
47	0-3-3	- 3	3 Nodular colloid, goiter
48	0-1-0	5	5 0 Fractured femur
49	0-1-0	4	4 0 Neurosarcoma
50	0-1-0	4	4 Nodular colloid goiter
	0-1-0	1	1 Hyperthyroidism
	0-1-0		Let
51	0-1-0	c	Hyperthyroidism
52	0-1-0	4	4 0 Hyperthyroidism
53	0-1-0	5	5 Hyperthyroidism
54	0-1-0	4	4 0 Hyperthyroidism
55	0-1-0	4	4 0 Hyperthyroidism
56	0-1-0	4	4 0 Hyperthyroidism
57	0-1-0	5	5 0 Hyperthyroidism
58	0-1-0	5	5 0 Hyperthyroidism
59	0-1-0	5	5 0 Hyperthyroidism
60	0-1-0	5	5 0 Hyperthyroidism
61	0-1-0	5	5 0 Hyperthyroidism
62	0-1-0	5	5 0 Hyperthyroidism
63	0-1-0	5	5 0 Hyperthyroidism
64	0-1-0	5	5 0 Hyperthyroidism
65	0-1-0	5	5 0 Hyperthyroidism
66	0-1-0	5	5 0 Hyperthyroidism
67	0-1-0	5	5 0 Hyperthyroidism
68	0-1-0	5	5 0 Hyperthyroidism
69	0-1-0	5	5 0 Hyperthyroidism
70	0-1-0	5	5 0 Hyperthyroidism
71	0-1-0	5	5 0 Hyperthyroidism
72	0-1-0	5	5 0 Hyperthyroidism
73	0-1-0	5	5 0 Hyperthyroidism
74	0-1-0	5	5 0 Hyperthyroidism
75	0-1-0	5	5 0 Hyperthyroidism
76	0-1-0	5	5 0 Hyperthyroidism
77	0-1-0	5	5 0 Hyperthyroidism
78	0-1-0	5	5 0 Hyperthyroidism
79	0-1-0	5	5 0 Hyperthyroidism
80	0-1-0	5	5 0 Hyperthyroidism
81	0-1-0	5	5 0 Hyperthyroidism
82	0-1-0	5	5 0 Hyperthyroidism
83	0-1-0	5	5 0 Hyperthyroidism
84	0-1-0	5	5 0 Hyperthyroidism
85	0-1-0	5	5 0 Hyperthyroidism
86	0-1-0	5	5 0 Hyperthyroidism
87	0-1-0	5	5 0 Hyperthyroidism
88	0-1-0	5	5 0 Hyperthyroidism
89	0-1-0	5	5 0 Hyperthyroidism
90	0-1-0	5	5 0 Hyperthyroidism
91	0-1-0	5	5 0 Hyperthyroidism
92	0-1-0	5	5 0 Hyperthyroidism
93	0-1-0	5	5 0 Hyperthyroidism
94	0-1-0	5	5 0 Hyperthyroidism
95	0-1-0	5	5 0 Hyperthyroidism
96	0-1-0	5	5 0 Hyperthyroidism
97	0-1-0	5	5 0 Hyperthyroidism
98	0-1-0	5	5 0 Hyperthyroidism
99	0-1-0	5	5 0 Hyperthyroidism
100	0-1-0	5	5 0 Hyperthyroidism

TABLE IV — BLOOD IODINE BEFORE OPERATION—Continued

No	Date	Gamma 1-100 c cm	Diagnosis
92	4-29-36	12.9	Toxic adenoma of thyroid
93	4-29-36	23.0	Thyroid adenoma with retrograde changes
94	4-30-36	11.1	Benign fetal adenoma
95	4-30-36	3.6	Colloid goiter
96	4-30-36	4.6	Recurrent hyperplastic (thyroidectomy 1921)
97	5-1-36	4.3	Prolapse of rectum thrombosed hemorrhoids
98	5-1-36	225.0	Obstruction of common duct
99	5-6-36	6.3	Diffuse nodular colloid
100	5-9-36	4.7	Chronic cholecystitis (?) no stones
101	5-11-36	4.0	Carcinoma of stomach inoperable
102	5-13-36	3.7	No diagnosis given
103	5-13-36	3.7	Nervous exhaustion intercostal neuritis
104	5-13-36	4.5	Sciatic chronic cholecystitis with stones
105	5-16-36	6.9	Acute bronchitis
106	5-16-36	4.2	Acute hydrops of gall bladder
107	5-16-36	5.0	Chronic appendicitis
108	5-18-36	4.6	Chronic cholecystitis with stones
109	5-18-36	14.3	Benign thyroid adenomas and damaged heart
110	5-19-36	6.9	Portal cirrhosis of liver ascites and jaundice
111	5-23-36	6.6	Benign thyroid adenomas with hemorrhage
112	5-25-36	5.3	Cancer of liver (nodules on liver)
113	5-25-36	3.7	No diagnosis given
114	5-26-36	4.3	Nodular colloid adenoma
115	5-28-36	5.9	Chronic cholecystitis subacute
116	6-3-36	3.2	Thyroiditis Riedel's-Woody
117	6-8-36	6.4	Nodular colloid adenoma
118	6-16-36	3.6	Uterine polyp
119	6-16-36	3.6	Tumor of left breast
120	6-16-36	8.0	Portal cirrhosis of liver ascites and jaundice
121	6-20-36	9.0	No diagnosis given
122	6-20-36	500-18.5	Chronic cholecystitis with stones
123	6-23-36	2.9	Endocervicitis endometritis salpingitis and appendicitis
124	6-24-36	11.1	Benign colloid goiter traces of fetal adenoma
125	7-6-36	2.0	Chronic cholecystitis subacute
126	7-6-36	180.0	Chronic cholecystitis and chronic appendicitis
127	7-11-36	3.2	No diagnosis enlarged gall bladder on x ray
128	7-14-36	4.3	Carcinoma of lymph gland highly malignant
129	7-23-36	3310.0	Chronic cholecystitis chronic thickening of appendix
130	7-27-36	470.0	Benign fetal adenoma had taken iodine
131	7-28-36	13.0	Chronic cholecystitis with stones (3 wks postoperative)
132	7-28-36	3.9	No diagnosis complaint pain in back

TABLE IV — BLOOD IODINE BEFORE OPERATION—Continued

No	Date	Gamma 1-100 c cm	Diagnosis
133	8-27-36	6.2	Nodular colloid goiter
134	8-27-36	10.6	Carcinoma of gall bladder
135	8-21-36	2920.0	Chronic cholecystitis fibrous subacute stones
136	9-6-36	5.2	Lymphatic leucemia
137	8-31-36	5.7	Either Hodgkin's disease or tuberculosis of lymph glands
138	9-17-36	40.5	Cholangitis acute due to biliary tract infection
139	9-17-36	18.7	Chronic cholecystitis with stones post operative
140	10-8-36	13.1	Toxic adenoma decompensated heart
141	10-12-36	2.5	Chronic cholecystitis fibrous
142	10-16-36	4.9	Chronic cholecystitis with stones
143	10-21-36	3.3	Chronic sinusitis chronic appendicitis
144	10-26-36	6.2	Nodular colloid goiter toxic diffuse
145	10-27-36	209.0	Hypertension is taking Lugol's etc
146	11-3-36	34.6	
147	11-6-36	4.7	Chronic cholecystitis with stones
148	11-7-36	4.2	Menopause
149	11-7-36	11.3	No diagnosis slightly enlarged gall bladder
150	11-13-36	6.6	Epilepsy idiopathic
151	11-14-36	7.1	Hypertension
152	11-16-36	7.9	Adenoma of thyroid fibroid of uterus
153	11-16-36	7.7	Hyperplastic thyroid
154	11-30-36	5.8	Hirsutism hypogonadism
155	12-2-36	4.0	Slight obesity
156	12-8-36	5.5	Hyperplastic thyroid
157	12-11-36	8.7	Large diffuse nodular toxic thyroid
158	12-12-36	8.5	Nodular toxic colloid
159	12-14-36	3.2	Thyroid adenoma recent focal hemorrhage
160	12-16-36	4.8	Breast duct hyperplasia with inflammation
161	12-16-36	6.9	Endometrial polyp postoperative
162	12-16-36	6.2	Multiple fibroids with uterine polyp
163	12-17-36	5.0	Ovarian cyst left
164	12-23-36	8.7	Uremic poisoning decompensated heart etc
165	1-23-36	5.0	Benign fetal adenoma of thyroid
166	12-28-36	6.9	Nodular colloid adenoma
167	12-29-36	5.6	Facial neuralgia
168	12-29-36	7.1	Nodular colloid goiter had iodine 2 days ago
169	12-30-36	5.3	Hypertensive heart disease vasomotor trouble
170	1-2-37	27.5	Chronic cholecystitis with stones
171	1-6-37	4.7	Chronic cholecystitis and general neurosis
172	1-6-37	5.8	Diffuse nodular toxic colloid goiter

TABLE IV.—BLOOD IODINE BEFORE OPERATION—Concluded

No	Date	Gamma 100 ccm	Diagnosis
13	1-7-37	11.2	Tonic hyperplasia thyroid
174	1-3-37	5.2	Nodular colloid goiter (?) cervix
175	1-8-37	409.0	Chronic cholecystitis with stones
176	1-8-37	4.2	Asthma
177	1-8-37	6.8	Hypertension
178	1-9-37	550.0	Chronic cholecystitis ovarian cyst
179	1-9-37	4.2	Bilateral salpingitis

182 1-1-37 8 nodular colloid enter diffuse toxic
 Person known to have had iodine administered within 30 days preceding the drawing of the blood sample for iodine analyses are noted as being such in Table IV with the exception of patients 40, 71, 110 and 111 who had tetraiodophenylphenol one day before drawing the blood. Later evidence leads us to think nine days is insufficient time to allow elimination of tetraiodophenylphenol in some liver and gall bladder cases.

damage of considerable duration was encountered. In no case did they feel they had reason to believe that death was due to cessation of liver function, but rather to its perversion.

It would seem not unreasonable to assume that "liver death" results from the placing of an extra strain upon a liver the Kupffer cells of which have been previously impaired. So long as the liver is put to no strain and stress other than that of ordinary living, to which it has accustomed itself so to speak, it is quite capable of carrying on. But when operation is undertaken an entirely different complexion is put on the matter. Even in the most favorable cases there are introduced alone or in combination the strain of the anesthetic, the trauma of surgical manipulation, the drop in intra abdominal temperature and the changes in intrahepatic and biliary pressure. The result is that a liver which is already the seat of a pathologic process is unable to cope with the added strain and its function promptly fails. The liver cells, as they become increasingly unable to fulfil their function, undergo some necrotic change, partly because of failing function and partly because of the changes in intrahepatic pressure brought about by operation. (1)

The value of the blood iodine estimation as a preliminary to any operation upon the biliary tract is indirectly emphasized by

TABLE V.—BLOOD IODINE—POSTOPERATIVE

No	Date	Gamma in 100 ccm		Diagnosis
			PO	
42	2-12-36	640.0	16.6	Chronic cholecystitis possible cancer of liver
47	2-20-36	16.6		Colloid goiter possible gall stones
49	2-25-36	73.6		Acute hydrops of gall bladder
61	3-7-36	3.9		Subacute cholecystitis
63	3-7-36	1,200.0		Subacute cholecystitis
64	3-8-36	6.72.0	Died	No operation. Corrosion duct obstruction
65	3-8-36	360.0		Chronic cholecystitis with stones carcinoma
71	3-10-36	1,000.0	40.0 3 wks	Chronic cholecystitis with stones
80	4-6-36	209.0		Chronic cholecystitis and chronic appendicitis
95	3-1-36	2.0	Died	Common duct obstruction
100	3-9-36	4.7		Chronic cholecystitis (?) no stones
106	3-10-36	4.2		Acute hydrops of gall bladder
108	3-13-36	6.6		Chronic cholecystitis with stones
110	3-10-36	6.0		Portal cirrhosis of liver w/b ascites and jaundice
112	3-13-36	3.3		Cancer of liver (nodules on liver)
115	3-18-36	5.9		Chronic cholecystitis subacute
120	6-2-36	8.0		Portal cirrhosis of liver ascites and jaundice
122	6-20-36	5.0	13.5 2 wks	Chronic cholecystitis with stones
123	7-6-36	2.0		Chronic cholecystitis subacute
126	7-6-36	180.0	32.0 4 wks	Chronic cholecystitis and chronic appendicitis
127	7-11-36	3.2		No diagnosis enlarged gall bladder on x ray
129	7-13-36	3.3	0.0	Chronic cholecystitis chronic thickened appendix
131	7-23-36	13.0		Chronic cholecystitis with stones
134	7-25-36	10.6		Carcinoma of gall bladder
135	8-11-36	2.0	50.0	Chronic cholecystitis fibrous subacute stones
136	9-17-36	49.5	6.4	Cholangitis acute due to biliary tract infection
139	9-17-36	16.7		Chronic cholecystitis with stones postoperative
141	10-12-36	2.5		Chronic cholecystitis fibrous
142	10-10-36	4.9		Chronic cholecystitis with stones
147	12-6-36	4.7		Chronic cholecystitis with stones
143	12-7-36	11.3		None slightly enlarged gall bladder
170	1-2-37	27.1		Chronic cholecystitis with stones
171	1-6-37	4.7		Chronic cholecystitis and general sepsis
175	1-8-37	400.0		Chronic cholecystitis with stones
178	1-9-37	360.0	8 1 mo	Chronic cholecystitis ovarian cyst

Schutz and his colleagues when they state that "it is difficult, if not impossible to estimate the degree of liver damage which is present prior to operation, since it is rather definitely demonstrated that the liver function, so far as its physiologic activity is concerned, is not disturbed"

Several years ago Graham proposed a roentgenological dye test. He had observed that in patients who died "liver deaths" following relatively simple operations on the biliary tract, there had always been high retention of the dye used in the pre-operative x-ray examination. "We have noted," he says, "a striking reduction in our operative mortality in cases of disease of the biliary tract since we began to pay attention to the information provided for us by testing the excretory function of the liver"

We feel that our plan of estimating the blood iodine, giving a correct interpretation of the relation of the liver to the storage of iodine in the blood, is of higher value than any of the tests previously recommended

SUMMARY

The observation that cholecystitis, cholelithiasis, and hepatitis are invariably accompanied by a high iodine content of the blood suggested the use of the blood iodine estimation as a measure of liver efficiency. Animal experimentation was undertaken to ascertain whether operations upon the biliary tract influenced the blood iodine, and if so, to what extent. The results of this experimentation are set forth in tabular form.

The information thus gained is of interest in connection with the so called "liver deaths," concerning which much has appeared in recent medical literature. The autopsy findings in such cases throw light upon the

part played by the liver in the metabolism of iodine, and also in some instances, suggest exactly what part of the hepatic structure may be concerned in this metabolism. It is the author's belief that iodine metabolism is the function of the stellate cells of Kupffer. References to literature tending to confirm this theory are cited.

Reference is made to present day tests of liver function which are now employed as preliminaries to operation upon the gall bladder and ducts. The estimation of blood iodine adds another very valuable test to those now in use.

REFERENCES

1. BOYCE, F. F., and McFETRIDGE, E. M. So called "liver death", clinical and experimental study. *Arch Surg*, 1935, 31, 103.
2. CURTIS, G. M. Iodine relationships of thyroid disease. *Surg., Gynec & Obst*, 1936, 62, 365.
3. DECOURCY, J. L. Blood iodine studies in cholecystic disease. In press.
4. DOETSCH, H. Untersuchungen ueber die Beziehungen zwischen Schilddruese und Leber. *Biochem Ztschr*, 1935, 279, 233.
5. GRAHAM, I. A. Estimating risk of operations on biliary tract by testing excretory function of liver. *Radiology*, 1933, 21, 191.
6. HEUER, G. J. Factors leading to death in operations upon gall bladder and bile ducts. *Ann Surg*, 1934, 99, 881.
7. JAFFE, R. H., and BERMAN, S. L. Relations between Kupffer cells and liver cells, functional studies. *Arch Path*, 1928, 5, 1020.
8. MANN, F. C. Cytology of the Liver and its Special Significance. Vol. 1, p. 335. New York: P. B. Hoeber, Inc. 1932.
9. PERKIN, H. J., LAHEY, F. H., and CATTELL, R. B. Blood iodine studies in relation to thyroid disease. *New England J Med*, 1935, 214, 45.
10. REPETTO, E. Ricerche sperimentali sulle correlazioni funzionali fra tiroide e fegato. *Arch ital di chir*, 1935, 40, 564.
11. ROWE, A. W. Endocrine studies: association of hepatic dysfunction with thyroid failure. *Endocrinology*, 1933, 17, 1.
12. SCHUTZ, C. B., et al. A contribution to the study of so-called liver death. *J Am M Ass*, 1932, 99, 633.
13. WELLER, C. V. Hepatic lesions with exophthalmic goitre. *Tr Ass Am Physicians*, 1930, 45, 71.

THE EFFECT OF SURGICAL DRAINAGE ON KIDNEYS DECLARED FUNCTIONLESS BY PRESENT TESTS OF RENAL FUNCTION

MAURICE GEORGE SCHULHOF, M.D., M.S., Rochester, Minnesota

INTRODUCTORY NOTE BY HUGH CABOT, M.D., F.A.C.S.

The term functionless kidney has been occurring in urological literature with increasing frequency since the development and perfection of a variety of methods of testing kidney function, the most recent of which is that of intravenous urography. It has not, I think, been sufficiently appreciated that the word functionless used in this connection should be taken literally. These tests do show that there is no evidence of function. On the other hand they cast little or no light upon anatomical facts which in the last analysis are of controlling importance. The great majority of these cases are associated with and apparently due to obstruction commonly at the ureteropelvic junction, but also in other portions of the ureters above the bladder.

Another point of importance is the extraordinary and as yet unexplained influence of a stone in the kidney upon the evidence of renal function as tested by our present inaccurate methods. It has been well known for many years that a relatively small stone lying in the kidney and not producing any high grade obstruction may yet depress function to an extent wholly misleading if this evidence be relied upon. Now the experimental work upon the effect of obstruction of the ureter, partial or complete upon the kidney has been somewhat contradictory. The older assumption that complete obstruction of the ureter was followed by atrophy of the kidney has been disproved. That some degree of hydronephrosis regularly occurs seems practically certain.

The most important and often the most difficult point upon which to get accurate in-

formation is the extent to which recovery of function will take place following satisfactory relief of the obstruction. The theory that once hypertrophy of the opposite kidney has developed the damaged kidney will not again regain some portion of its functional capacity has been advanced and has considerably affected our plans of treatment. Many surgeons have had clinical evidence which led them to doubt the soundness of this conclusion, but such experiences are notoriously unreliable in so far as they depend upon evidence not based upon accurate and prolonged studies which enable us to state the apparent functional capacity of the kidney before relief of the obstruction and over a considerable period following the more or less complete relief of the impediment.

At my suggestion Dr. Schulhof has undertaken a most painstaking review of a large group of cases in which great or apparent complete loss of function existed and in which the obstruction was removed. His study has required him to exclude from his conclusions the great majority of the cases on the grounds that they were due (1) to the presence of stone thereby introducing an incalculable factor or (2) because though the evidence of restoration of function was clinically satisfactory there was incomplete pre-operative or post-operative study upon which to base a conclusion. It has thus occurred that he has selected for the basis of his conclusions a relatively small group of cases. In these cases however the pre-operative and postoperative evidence seems very complete. His study appears to me to remove quite satisfactorily from the realm of unprecision and personal opinion the problem here studied. The paper seems to be important as putting upon a solid basis the opinion held by many observers that

From the Department of Surgery, The Mayo Foundation, Submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

very great recovery of function can be obtained and that many kidneys having no apparent functional value can be restored to a degree of usefulness, which is of first class importance to the patient

THE present study was undertaken in order to supply clinical evidence on which to base an opinion that certain kidneys pronounced functionless by present methods of determining renal efficiency will respond to surgical drainage and display sufficient functional capacity to merit their conservation

It has been the contention of some workers, notably Hinman, that such rehabilitation does not take place. He stated "The healthier side will gradually undergo compensatory hypertrophy which may be so capable of counterbalance as to render the work of its weak assistant unnecessary, disuse atrophy of which will progressively occur. The reapportionment of functional activity after alteration occurs by a competitive type of anatomic compensation." While his contribution is an excellent one, and has been the stimulus for further investigation, similar results have not been obtained by other careful workers in this field. Joelson, Beck, and Moritz in their study were unable to agree with Hinman's conclusions. Their experiments did not demonstrate any renal atrophy of disuse, and, in fact, strongly suggested that such atrophy does not occur. They said "In view of the experimental data, the theory of renal counterbalance need not be seriously considered in deciding the surgical treatment for certain renal lesions."

Clinically, there has been lack of confirmation of Hinman's theory that when renal function is disturbed by obstruction on one side, atrophy of disuse follows when the obstruction is removed and the kidney is placed in functional competition with its hypertrophied fellow on the opposite side. Gutierrez asserted that it was remarkable to note the functional powers of regeneration possessed by a kidney with hydronephrosis. Walters concluded that there was a remarkable return of renal function after the removal of obstructing lesions. Crosbie and Dix asserted that there were

many cases in which excessive renal destruction and low function gave rise to the question of nephrectomy, but that many times after prolonged drainage sufficient function returned to make it worth while to save the kidney

PLAN OF STUDY

In order to ascertain the number of, and to study statistically, kidneys declared functionless and treated by conservative surgical drainage, it was necessary to review all the cases in which nephrostomy, pelviostomy, or ureterostomy had been performed at the clinic. In this review, all cases in which renal calculi were present were excluded, since it is generally agreed that abeyance of function in such kidneys may be explained on the assumption of "reflex anuria," and hence such kidneys are not truly functionless. Another group of cases, including those in which uretero-enterostomy was done, and of which there were a considerable number, were not studied because of obvious difficulties in determining postoperative renal function.

Procedure A detailed history was obtained in all cases in this series, a thorough physical examination was performed, and special studies as well as routine laboratory tests were made when indicated. A separate urologic investigation was carried out.

Roentgenograms of the urinary tract were made in all cases, the first of renal regions and upper portions of the ureters, another of the lower portions of the ureters, bladder, and prostatic region. This study revealed the presence, size, and position of the kidneys, and opaque shadows in the renal, vesical, or prostatic areas, occasionally, vesical filling defects were also noted, the vesical urine serving as contrast medium.

Preliminary to cystoscopic examination, blood urea and combined phenolsulphonphthalein determinations were made, and on introduction of the cystoscope, the presence of any residual urine was noted. The ureters were catheterized, with aspiration of the renal pelvis to ascertain retention. Indigo carmine or differential phenolsulphonphthalein studies were carried out and retrograde pyelograms made when indicated. Sterile specimens of urine from each kidney were

examined routinely, freshly stained smears of the centrifuged sediment were searched for organisms, and a portion of each specimen was cultured. Immediately preceding the making of urograms, roentgenologic examination of the urinary tract was repeated. Following the intravenous injection of the contrast medium, films were taken at intervals of 5, 15, 30, and 60 minutes. Some "delayed films" were made after 2 hours. Roentgenograms were made with the compression bag in place, the pressure being removed after the 15 minute exposure. Upright, horizontal and delayed films were made in cases in which there was a history of postural relief of pain and in which it was suspected that there was abnormal mobility of the kidneys. This was done in order to determine the degree of renal excursion as well as the presence of inadequate drainage from the renal pelvis.

In the group of cases finally selected for study, the diagnosis of functionless kidney was based on the history, physical examination, laboratory studies including indigo carmine and phenolsulphophthalein tests, cystoscopic investigation, and roentgenographic examination by means of intravenous urography.

Following surgical intervention the daily output of urine was noted, and the pre-operative tests were repeated for purposes of comparative study.

REPORT OF CASES

CASE 1. A woman 31 years of age presented herself at the clinic in 1930 with a history of dull pain in the lower left abdominal quadrant for a period of 3 or 4 years. There was definite tenderness in the left costal angle on palpation. The urine contained pus grade 2 but on culture was negative. The value for urea was 24 milligrams per 100 cubic centimeters of blood. Cystoscopic examination revealed mild chronic cicatricial urethritis. Indigo carmine appeared from the right kidney in 7 minutes in a concentration of grade 2; no dye was seen to come from the left side in 15 minutes. Retrograde pyelograms disclosed bilateral hydronephrosis of grade 4. A diagnosis of bilateral hydronephrosis and functionless left kidney was made. Left nephrostomy was performed immediately.

During convalescence, which was uneventful from 400 to 700 cubic centimeters of urine drained from the kidney, the specific gravity varied from 1.001 to 1.011. Infection continued as was evi-

denced by the presence of pus grade 2 in the urine. Cultures of urine however continued negative. Indigo carmine appeared from the right side in 12 minutes in a concentration of grade 2; there was an identical appearance time and concentration on the left. The post-operative intravenous urograms revealed a fair concentration of medium in the 20 minute film on the left and normal visualization on the right. The bilateral hydronephrosis of grade 4 persisted. In a recent letter the patient said that except for an occasional ache in the left lower quadrant she was enjoying good health. The nephrostomy tube was removed after 4 months and functional studies revealed a concentration of indigo carmine of grade 2+ in 10 minutes from both sides. The intravenous urograms were described as unchanged except that the pelvis of the left kidney had contracted down to within normal limits.

CASE 2. A man 27 years of age was admitted to the clinic in 1930 with the complaints of burning and frequency of urination, hematuria and a dull pain in the left lumbar region for 6 months. Roentgenograms of the kidneys, ureters and bladder were negative. The vesical urine contained erythrocytes grade 3 and pus grade 3. Culture of the urine gave a growth of *Staphylococcus aureus* and *Escherichia coli*. A combined phenolsulphophthalein test disclosed a return of 35 per cent of the dye. Cystoscopy revealed a real cystitis of grade 2 and clear spurs from the right ureteral orifice; the left orifice could not be located. A differential function test with indigo carmine showed a concentration of grade 4 in 5 minutes on the right and a total absence of secretion of dye on the left in 15 minutes.

A diagnosis of infected hydronephrosis with functionless left kidney was made. Nephrostomy was performed through the middle calyx. Following operation the output of urine from the left kidney rose to between 200 and 1350 cubic centimeters for 24 hours; the specific gravity of the urine varied from 1.005 to 1.008. The daily excretion of urine from the right kidney varied from 525 to 2550 cubic centimeters and it had a specific gravity of from 1.010 to 1.012. A differential phenolsulphophthalein test gave a 50 per cent return of dye from the bladder and 30 per cent from the left kidney. The patient was dismissed in excellent condition with the nephrostomy tube in place. The tube was removed by the patient's local physician 11 months later and the wound healed nicely. At that time the patient was free of symptoms and able to carry on his daily work.

CASE 3. A woman 43 years of age was admitted to the clinic in 1930 because of recurrent left lumbar pain of 11 months duration. In the month prior to her arrival at the clinic she had noted blood in her urine on several occasions. Erythrocytes grade 4 and pus grade 3 were noted in the urine but no organisms were grown on culture. There was dilatation grade 2 to 3 of the pelvis and calyces on the right in the 20 minute urogram and indications of good function. A trace of medium was present over the left renal pelvis in the 60 minute film. On cyst-

toscopy clear spurts were seen to come from the right kidney. No flux was noted from the left ureteral orifice in 10 minutes. A differential indigocarmine test gave a return of dye from the right side in 7 minutes in a concentration of grade 4, there was no appearance of the dye from the left side in 15 minutes. A diagnosis of bilateral hydronephrosis and functionless left kidney was made.

Re-section of the left renal pelvis and nephrostomy were performed. The urinary output after operation was between 600 and 1350 cubic centimeters daily from the left kidney, the urine having a specific gravity of from 1.006 to 1.013. The 24 hour specimen of urine from the right kidney measured from 400 to 1500 cubic centimeters, its specific gravity ranging from 1.008 to 1.012. The value for urea was 24 milligrams per 100 cubic centimeters of blood. A differential function test with indigocarmine showed a concentration, grade 3, from the right kidney in 8 minutes and a concentration of grade 2 from the left kidney in 9 minutes. There was a good concentration of medium on both sides in the 20 minute intravenous urogram. There was bilateral dilatation of the pelvis and calyces, grade 2. The nephrostomy tube was removed 2 months after operation.

The patient returned to the clinic in 1933. At that time, an intravenous urogram was done, and pelvis and calyces on both sides were well visualized in the 5 minute film. Caliectasis, pyelectasis and ureterectasis, grade 2, were still present as in previous examinations. The patient said that she had been enjoying excellent health and that her strength and endurance were good.

CASE 4 A woman, 34 years of age, was admitted to the clinic in 1931 with a history of left renal colic, and a mass in the left upper abdominal quadrant for the previous year. Her urine contained pus, grade 2, and culture gave a growth of *Escherichia coli* and *Pseudomonas*. The blood contained 16 milligrams of urea per 100 cubic centimeters.

Roentgenograms of the kidneys, ureters, and bladder were negative. Cystoscopic examination of the bladder revealed normal findings. Indigocarmine appeared from the right kidney in a concentration of grade 4 after 5 minutes, no dye was recovered from the left kidney after 15 minutes. Pyelograms revealed dilatation of the pelvis, calyces and ureter, grade 3, on the left and grade 1 on the right. In the intravenous urograms visualization was absent on the left at the end of 60 minutes, function was unimpaired on the right. Left nephrostomy was performed, the Cabot technique being used.

The operative convalescence was uneventful. Specimens of urine from the renal stoma contained erythrocytes, grade 1, and pus, grade 1, the vesical urine contained pus, grade 1. *Pseudomonas* organisms were cultured from this urine. The output of urine from the bladder ranged from 1000 to 1,900 cubic centimeters, its specific gravity being from 1.007 to 1.023. The left kidney excreted between 550 to 1040 cubic centimeters of urine each 24 hours, with a specific gravity of from 1.004 to 1.013. Two

weeks following operation, a differential phenol sulpholphthalein test showed a recovery of 55 per cent of the dye from the right and 23 per cent from the left. Intravenous urograms taken 6 months later gave fairly good visualization of the left kidney in the 20 minute film and showed hydronephrosis of grade 3, there was good concentration of medium on the right, showing hydronephrosis of grade 1. In a letter the patient's local physician 2 years later said that the patient had gained considerable weight and that her general physical condition had been unusually good.

CASE 5 A man, 45 years of age, came to the clinic in 1931 because of attacks of pain in the left lumbar region of 8 years' duration. Roentgenograms of the bladder, kidneys, and ureters were negative. The value for blood urea was 56 milligrams per 100 cubic centimeters. The urine contained erythrocytes, grade 2, and pus, grade 4. Cultures of urine revealed *Proteus ammoniæ*. Cystoscopic examination was essentially negative. Differential function tests with indigocarmine revealed a concentration of grade 2 in 15 minutes on the right and a total absence of secretion of dye on the left. Intravenous urograms revealed faint visualization on the right in the 20 minute film and no evidence of medium on the left in the 60 minute exposure. On retrograde pyelography, bilateral hydronephrosis, grade 4, was demonstrated. A diagnosis was made of bilateral infected hydronephrosis, with a functionless left kidney and a reduction in function on the right.

Bilateral nephrostomy was performed. Immediately following operation, each kidney excreted between 800 and 1000 cubic centimeters of urine in 24 hours, with a range in specific gravity from 1.004 to 1.010. Daily microscopic examination revealed moderate infection. Two weeks following operation, 20 per cent of phenol-sulpholphthalein was recovered from each kidney. At the time of dismissal, 1 month later, the value for urea was 42 milligrams per 100 cubic centimeters of blood.

In 1933, 2 years later, the patient returned to the clinic because of another complaint (cholecystitis). He volunteered the information at this time that his kidneys had given him no further trouble. Both renal stomas were functioning well and had given him no discomfort. The urine contained pus, grade 1, and the value for blood urea was 38 milligrams per 100 cubic centimeters.

CASE 6 In 1930 a man, 34 years of age, presented himself at the clinic with the history of pain in the right lumbar region and backache for several years. Pus, grade 2, was present in the urine, but no growth was obtained on culture. A roentgenogram of the genito urinary tract showed no abnormal shadows in the region of the kidneys, ureters, or bladder. A minute amount of medium was noted in the 60 minute intravenous urogram over the right renal area, while on the left, visualization and outline were normal in the 5 minute exposure. The value for urea was 20 milligrams per 100 cubic centimeters of blood. On cystoscopic examination, the right

ureteral orifice could not be seen but clear spurt were seen to come from the left ureteral orifice. Indigo carmine appeared from the left in a concentration of grade 4 in 5 minutes and was absent from the right in 15 minutes. A 40 per cent return of dye was obtained on the combined phenol sulphophthalein test. A diagnosis of functionless right kidney was made and exploration was advised.

Nephrostomy was performed. The daily urinary output from the kidney varied from 850 to 1050 cubic centimeters with a specific gravity of from 1.006 to 1.012. The left kidney excreted from 200 to 1800 cubic centimeters of urine daily with a specific gravity of from 1.007 to 1.016. The value for blood urea remained stationary. Twenty three per cent of phenolsulphophthalein was returned from the right kidney and 32 per cent from the bladder with the differential test. Visualization was good on both sides in the 15 minute urogram the pelvis, ureter and calices were within normal limits. The nephrostomy tube was removed 1 year later at which time the patient was doing his usual work.

CASE 7. A man aged 48 years came to the clinic in 1934 complaining of diurnal frequency of urination and hematuria of 3 years duration. His urine contained erythrocytes, grade 1 and pus grade 4 and on culture was found to contain micrococci. The value for blood urea was 22 milligrams per 100 cubic centimeters. Cystoscopy disclosed an infiltrating tumor involving the right lateral and posterior wall of the bladder and also a suggestion of infiltration on the left lateral wall close to the sphincter. The pathologic diagnosis was "squamous-cell carcinoma grade 4 (Broders method). Because of the extreme intolerance of the bladder it was deemed inadvisable to continue with further examinations and differential tests were not made. Roentgenographic studies on the left revealed dilatation of the calices, pelvis and ureter grade 2 with normal function. On the right there was no visualization of medium in any film including the 60 minute one. A diagnosis of "squamous cell carcinoma of the bladder, bilateral hydronephrosis and functionless right kidney" was made.

Bilateral cutaneous ureterostomy was performed. The urinary output for 24 hours on the left was from 1000 to 1500 cubic centimeters with a range of specific gravity from 1.010 to 1.015. On the right the daily excretion was from 750 to 1000 cubic centimeters and the specific gravity varied from 1.012 to 1.014. A differential phenolsulphophthalein test gave a return of 30 per cent on the left and 19 per cent on the right. The value for blood urea remained normal (18 milligrams per 100 cubic centimeters). Retrograde pyelograms taken 2 weeks after operation disclosed a normal pelvis and calices with dilatation of the ureter grade 2 on the right and normal pelvis, calices and ureter on the left. Intravenous urograms revealed beginning visualization on both sides in the 5 minute film and good visualization in the 20 minute film with outlines coinciding closely with those in the pyelograms. A course of deep

roentgen therapy was given as soon as the post-operative condition would permit. The patient returned for re-examination 4 months later. Intravenous urography revealed no change and the function of both kidneys on this basis was thought to be good. It was learned that this patient died 14 months later.

CASE 8. In 1935 a girl 9 years of age was brought to the clinic having had pain in the left flank since the age of 5 years. A catheterized specimen of urine was negative on routine examination but on culture the *Escherichia coli* was obtained. The blood urea was 20 milligrams per 100 cubic centimeters. Ordinary roentgenograms of the kidneys, ureters and bladder were negative. There was a normal appearance time and concentration of medium on the right in the intravenous urogram. The outlines of the pelvis, calices and ureters were within normal limits. On the left there was only a faint suggestion of medium in the 60 minute film. A diagnosis of left hydronephrosis and functionless kidney was made.

Plastic repair of the renal pelvis was carried out followed by decapulation and a Cabot type of nephrostomy. The output of urine from the left kidney varied from 100 to 850 cubic centimeters for 24 hours. The daily output from the bladder ranged from 250 to 1200 cubic centimeters. Undoubtedly a portion of urine excreted by the left kidney passed into the bladder. The specimens from the bladder and nephrostomy tube were negative microscopically. Culture continued to show the *Escherichia coli* in urine from both kidneys. The value for urea was 24 milligrams per 100 cubic centimeters of blood. Intravenous urograms taken 3 weeks after operation disclosed beginning visualization on both sides in the 5 minute film, good concentration on the right in the 20 minute exposure and best visualization on the left in the 60 minute film. The left calices, pelvis and ureter were dilated grade 2+; the right kidney was normal. This patient has not been heard from since dismissal.

CASE 9. In 1935 a man 38 years of age came to the clinic with the complaints of diurnal frequency and hematuria for 1 year. An ordinary roentgenogram of the abdomen was negative. The blood urea was 40 milligrams per 100 cubic centimeters. The urine contained erythrocytes, grade 1, and pus cells, grade 2. *Aerobacter aerogenes* was cultured from the urine. Cystoscopic examination revealed a grade 4 squamous cell epithelioma of the base and left wall of the bladder in the region of the left ureter. No spurt was seen to come from the left ureter. The intravenous urograms were normal on the right. There was no evidence of medium on the left in any film including the 60 minute one. Suprapubic cystostomy was done with fulguration of the lesion and insertion of radon seeds. Three months later bilateral cutaneous ureterostomy was performed. Immediately following this operation the daily urinary output on the left ranged from 100 to 500 cubic centimeters with a specific gravity of from 1.006 to 1.017. On the right the 4 hour output was from

450 to 3,400 cubic centimeters, with a specific gravity of from 1.008 to 1.010. The phenolsulphonphthalein test showed a return of 15 per cent of the dye on the left and 29 per cent on the right. The intravenous urogram revealed normal outlines, appearance time, and concentration of medium on both sides. The value for blood urea was 36 milligrams per 100 cubic centimeters. The patient was dismissed 3 months following the second operation with the ureteral stomas functioning well.

CASE 10. A man, 52 years of age, registered at the clinic in 1934 with a history of pain in the left flank and intermittent hematuria for 3 or 4 years. The urine contained pus, grade 1, and on culture gave a growth of *Escherichia coli* and *Proteus ammoniae*. The value for urea was 44 milligrams per 100 cubic centimeters of blood. Intravenous urograms revealed no visualization on the left in any film. The right side was normal in outline, appearance time, and concentration of medium. A diagnosis of functionless, infected left kidney and hydronephrosis was made, and left nephrostomy was performed. On the nineteenth postoperative day an intravenous urogram was made. There was fair visualization on the left in the 5 minute film, concentration of the medium being best in the 20 minute film. The outline of the kidney was normal except for slight dilatation of the middle calyx. The right kidney appeared normal as before. The urine contained pus, grade 3, and on culture of urine from the nephrostomy tube *Escherichia coli* and *Proteus ammoniae* were found. The urinary infection was cleared up before the patient was dismissed, on dismissal the nephrostomy tube was still in place. Three months later the tube was removed by the patient's local physician, and one year after his dismissal the patient wrote that he was enjoying good health and was free of symptoms.

SUMMARY

In 260 cases in which surgical drainage was performed on the kidney for conditions other than lithiasis, 40 operations were performed on apparently functionless kidneys. Of this group, 10 cases were selected because relatively complete studies were carried out which appeared to authorize the drawing of conclusions. It will be noted that the 10 cases are divided into 2 groups: the first 6 cases comprising a group in which complete preoperative and postoperative studies were made, the last 4 a group in which intravenous urography alone was used as a test of differential function.

In these 10 cases 4 of the patients were females, 6 males. The average age at the time of operation was 38 years, the youngest patient being 9 years old and the oldest, 52. The

average age at the onset of symptoms was 35 years. Thus the average time which elapsed between the onset of symptoms and operative intervention was 3 years. Although it is impossible to state with any accuracy the length of time during which renal function had been impaired in these cases, it was doubtless sufficiently long to produce compensatory hypertrophy.

In 9 cases there was pus in the urine. Positive cultures were obtained in 6 cases, *Escherichia coli* being the predominating organism. *Pseudomonas*, *Proteus ammoniae*, *Aerobacter aerogenes* and micrococci were other offenders. In 4 cases in which *Escherichia coli* had been demonstrated before operation, it could not be cultured from the postoperative specimens. The value for blood urea was normal in 8 cases before operation, abnormal in 2. In 8 cases the left kidney was involved, in 2 the right kidney. In 8 cases nephrostomy was performed, while in the 2 remaining cutaneous ureterostomy was resorted to. In 5 cases in which both dye tests and intravenous urography were employed to ascertain differential renal function, there was close agreement between the 2 concerning the state of renal efficiency. In most cases the period of time which elapsed between the operation and the postoperative tests of renal function was about 20 days.

Effect of drainage. Definite improvement was noted in renal function in each of the 10 cases as a result of surgical drainage. In 4 cases the drained kidney functioned equally as well as the opposite kidney, in 5 cases function returned to approximately 50 per cent of that of the other side, and in 1 case function returned to the extent that good visualization was delayed to the 60 minute intravenous urogram.

CONCLUSIONS

It appears from this study that Hinman's theory of renal counterbalance is not supported by the clinical evidence. On the basis of the tests which were here applied, the kidneys were found to be functionless, but following surgical drainage there was a return of function.

A kidney cannot be declared functionless by these tests short of determining its complete

absence or complete destruction, and the only useful criteria of the extent of renal function, therefore, would appear to be exploration and drainage

Many so called functionless kidneys are valuable and should be preserved

REFERENCES

- 1 CROSSIE A H The rôle of nephrostomy in genito-urinary surgery J Urol 1925, 14 249-252
- 2 DIX, V W Some observations on temporary drainage of the kidney Proc. Roy Soc Med (Pt 2) 1933 26 1072-1076
- 3 GUTIERREZ ROBERT Hydronephrosis In Hugh Cabot's Modern Urology 3d ed vol. 2 414-457 Philadelphia Lea & Febiger 1936
- 4 HENMAN FRANK Renal counterbalance Arch Surg 1926 12 1102-1123
- 5 JOELSON J J BECK C S, and MORITZ A R Renal counterbalance Arch Surg, 1929, 19 673-711
- 6 WALTERS WALTMAN Restoration of renal function following removal of obstructing lesions Ztschr f urol Chir 1933 36 264-275

LOW BACK PAIN AND SCIATICA

Its Etiology, Diagnosis, and Treatment

A GURNEY KIMBERLEY, M D, D Sc (Med), Portland, Oregon

A GREAT number of anatomical variations may exist at the junction of the lumbar spine with the sacrum. Whether or not these are incomplete evolutionary changes attempting to adjust man to his erect posture and orthograde gait is of no clinical importance, but the fact that they exist is in part responsible for the frequency of low back pain and accompanying sciatica.

Under the soundest of mechanical arrangements one encounters at the lumbosacral junction, it is still the most vulnerable portion of the spine and is subjected to the greatest strain. It is the meeting place of an articulated column (the spine) with a relatively immovable structure (the pelvis). The axis of body weight falls anterior to the lumbosacral juncture and makes an angle with a line bisecting the first sacral vertebra to a degree proportional to the obliquity of the upper surface of the sacrum with the horizontal. The lumbosacral joints must bear the body weight and, in addition, any weight lifted by the upper extremities or borne upon the shoulders. Often lifting is done near the extremes of motion permitted by the spinal joints, so that its leverage is great and the resultant stresses magnified. Faults of posture increase the stresses present in proportion as they shift the axis of weight bearing from a center passing through the lumbosacral junction.

The foramina between the sacrum and the fifth lumbar vertebra are usually the smallest of the intervertebral foramina, yet they contain the largest of the spinal nerves. These nerves, together with their surrounding plexus of veins, almost fill the canals. The walls of the bony canal through which the fifth lumbar nerve passes are of peculiar interest, for posteriorly are the posterior spinal articulations, antero internally the intervertebral disc, and postero-externally the lumbosacral and ilio-

lumbar ligaments. The dorsal primary division of the nerve turns backward to supply the sacrospinalis muscle, and in its course runs close to the lateral aspect of the posterior articulation supplying the joint capsule itself.

These relationships make it possible for the fifth lumbar nerve to be affected by the slightest of inflammatory changes in the posterior articulations, by extrusions of the annulus fibrosus or nucleus pulposus, by any change in shape or size of the canal secondary to displacement of the fifth lumbar on the sacrum or atrophy of the intervertebral disc. A somewhat comparable situation is faced by the fourth lumbar nerve, which, however, is smaller and its foramen slightly larger.

Ligamentous and muscular injuries following excessive strains or unexpected loads, or the gradual weakening of soft tissue supports that come as the individual recedes from his prime may throw upon this vulnerable area a load it is not prepared to assume, and there result the symptoms and signs of lumbosacral strain.

The slight margin of safety present in the asymptomatic individual by reason of soft tissue support is further jeopardized by (1) anatomical variations from the normal which either cause increased motion at the expense of stability, or, by reason of their asymmetry, produce abnormal stresses, (2) degenerative changes, a resultant of the excessive trauma to which this area is subjected.

ANATOMICAL VARIATIONS IN THE POSTERIOR ARTICULATIONS

The articulations between the lumbar vertebrae are in the sagittal plane. At the lumbosacral juncture the plane of the joints may range from the sagittal to the coronal. The latter allows rotation and more lateral motion, as well as flexion and extension, but does so at the expense of stability. The tilt of the articulations often varies on the two sides,



Fig 1 Illustrating absolute asymmetry of the posterior lumbosacral articulations and a spina bifida occulta, findings corroborated at operation. In the interlaminal space between the first sacral and the fifth lumbar is seen a nub of bone representing the Anlage of the spinous process of the fifth lumbar. The right transverse process of the fifth lumbar is large but forms no pseudarthrosis with either the sacrum or ilium. Patient was entirely well 3 years after a spinal fusion of first sacral to fourth lumbar vertebra.

one may even be in the sagittal plane while the other is directly coronal (Fig 1). As they vary in direction so they may also vary in size.

In 3,000 roentgenograms of the lumbosacral spine Brailsford found that in 57 per cent the posterior articulations faced backward (coronal), 12 per cent inward (sagittal) and in 31 per cent they were grossly asymmetrical. Actually in specimens of the human skeleton and at lumbosacral fusion operations, one seldom finds absolute symmetry of the joints in either size or shape. Generally too the posterior articulations will be found transitional between the coronal and sagittal planes, and more often approach the former. To find a person suffering from low back pain in whom the posterior lumbosacral joints are symmetrical and exactly in the sagittal plane is so rare at this clinic as to excite much comment. If the posterior articulations are coronal but

exactly similar, motion is free and smooth. However, its greater range puts more strain upon supporting ligaments and muscles. Where asymmetry exists the movement on one side must be eccentric to movement on the other, and trauma with resulting synovitis and arthritis can be easily induced. By irritation of the fifth lumbar nerve branches supplying the supporting ligaments and muscles of the joint and its capsule, and by reason of inflammation spreading to contents of adjacent intervertebral canal pain radiates in fifth lumbar nerve distribution in back and lower extremity. As elsewhere in the body when joints are inflamed muscles attempt to splint the joint by going into tonic spasm thus causing more muscle fatigue and tenderness and completing the picture of lumbosacral strain.

Where the joints are asymmetrical, partial subluxation with locking is more likely to take place accounting perhaps for some cases of sudden onset of low back pain accompanied by a definite snap and for sudden relief from the same pain with a definite snap either spontaneously or as the result of manipulation. Subluxations are sometimes seen at operation, especially when there has been some atrophy of the intervertebral disc.

Some degree of asymmetry of the posterior articulations is seen in most roentgenograms taken of the lumbosacral area in persons suffering low back pain. In 30 cadavers selected at random by von Lackum none had exactly symmetrical lumbosacral joints though 6 were nearly so. Eighteen were grossly asymmetrical and the 6 remaining more or less so. The constant trauma of eccentric motion may cause permanent osteoarthritis of the joints and chronic inflammatory changes in the structures contained in the adjacent intervertebral foramina. It has been noted in cadavers and at operations that when the lumbosacral joints are asymmetrical the joint closest to the coronal plane will have the more marked arthritic changes.

POSTERIOR DISPLACEMENT OF THE FIFTH LUMBAR VERTEBRA

Posterior displacement of the fifth lumbar vertebra (Fig 2) was recognized as a developmental anomaly by Ferguson at the New York



Fig 2 Posterior displacement of the fifth lumbar vertebra on the first sacrum, and an acute lumbosacral angle. Patient completely relieved of symptoms by a lumbosacral fusion. Follow up period 3 years.



Fig 3 A transitional fifth lumbar vertebra.

Orthopaedic Dispensary and Hospital in 1924. The patient (No 71821) in whom this condition was first found had a lumbosacral fusion on May 28, 1924. Previously posterior displacement of the fifth lumbar vertebra had been noted in connection with fracture dislocation and also with tuberculosis of the vertebral body. However, it was not recorded in the literature from our institution until mentioned by Hibbs and Swift (1929) and Smith (1929). Similar observations were later published in American journals by Williams (1934), and again by Smith (1934). Under the name of posterior spondylolisthesis it was described in European literature by Sicard, Haguenau, and Wallich (1928), Perrier (1929) and Junghans (1930).

Posterior displacement of the fifth lumbar vertebra is commonly found in individuals having low back and sciatic pain. It was demonstrable in the roentgenograms of 235 (20.3 per cent) of 1,157 consecutive patients who were treated at this clinic for low back

and sciatic pain. In nearly all these cases the posterior articulations were either in the coronal plane or nearly so. We believe it is one of the developmental anomalies most commonly associated with an unstable fifth lumbar vertebra. This condition has been called by Willis an optical illusion. However, we have roentgenographic evidence of posterior displacement as great as seven-sixteenths of an inch and must of necessity consider it real. A posterior displacement may be acquired in true atrophy of an intervertebral disc from any cause and in fracture dislocations of the vertebral bodies. These acquired displacements, when extreme, may cause direct pressure upon the lumbar nerves within the intervertebral foramina. If the intervertebral disc is normal there is no posterior displacement of the inferior articular processes of the fifth lumbar vertebra, conclusive evidence in support of the theory that the posterior displacement of the body is developmental. When there is true atrophy of the disc the posterior articulations are subluxated and marked osteoarthritic changes are found at operation.



Fig 1 Illustrating absolute asymmetry of the posterior lumbosacral articulations and a spina bifida occulta finding corroborated at operation. In the interlamina space between the first sacral and the fifth lumbar is seen a nub of bone representing the anlage of the spinous process of the fifth lumbar. The right transverse process of the fifth lumbar is large but forms no pseudarthrosis with either the sacrum or ilium. Patient was entirely well 3 years after a spinal fusion of first sacral to fourth lumbar vertebra.

one may even be in the sagittal plane while the other is directly coronal (Fig 1). As they vary in direction so they may also vary in size.

In 3,000 roentgenograms of the lumbosacral spine Brailsford found that in 57 per cent the posterior articulations faced backward (coronal), 12 per cent inward (sagittal) and in 31 per cent they were grossly asymmetrical. Actually in specimens of the human skeleton and at lumbosacral fusion operations, one seldom finds absolute symmetry of the joints in either size or shape. Generally too the posterior articulations will be found transitional between the coronal and sagittal planes, and more often approach the former. To find a person suffering from low back pain in whom the posterior lumbosacral joints are symmetrical and exactly in the sagittal plane is so rare at this clinic as to excite much comment. If the posterior articulations are coronal but

exactly similar, motion is free and smooth. However, its greater range puts more strain upon supporting ligaments and muscles. Where asymmetry exists the movement on one side must be eccentric to movement on the other, and trauma with resulting synovitis and arthritis can be easily induced. By irritation of the fifth lumbar nerve branches supplying the supporting ligaments and muscles of the joint and its capsule, and by reason of inflammation spreading to contents of adjacent intervertebral canal, pain radiates in fifth lumbar nerve distribution in back and lower extremity. As elsewhere in the body when joints are inflamed, muscles attempt to splint the joint by going into tonic spasm, thus causing more muscle fatigue and tenderness and completing the picture of lumbosacral strain.

Where the joints are asymmetrical, partial subluxation with locking is more likely to take place, accounting perhaps for some cases of sudden onset of low back pain accompanied by a definite snap and for sudden relief from the same pain with a definite snap, either spontaneously or as the result of manipulation. Subluxations are sometimes seen at operation especially when there has been some atrophy of the intervertebral disc.

Some degree of asymmetry of the posterior articulations is seen in most roentgenograms taken of the lumbosacral area in persons suffering low back pain. In 30 cadavers selected at random by von Lackum, none had exactly symmetrical lumbosacral joints though 6 were nearly so. Eighteen were grossly asymmetrical and the 6 remaining more or less so. The constant trauma of eccentric motion may cause permanent osteoarthritis of the joints and chronic inflammatory changes in the structures contained in the adjacent intervertebral foramina. It has been noted in cadavers and at operations that when the lumbosacral joints are asymmetrical the joint closest to the coronal plane will have the more marked arthritic changes.

POSTERIOR DISPLACEMENT OF THE FIFTH LUMBAR VERTEBRA

Posterior displacement of the fifth lumbar vertebra (Fig 2) was recognized as a developmental anomaly by Ferguson at the New York



Fig 6 Spondylolisthesis in a 28 year old man. The defect in the lamina of the fifth lumbar vertebra is plainly visible. Patient complains of low back and sciatic pain of 8 months' duration.



Fig 7 Spondylolisthesis. This anteroposterior view shows the shadow of the fifth lumbar vertebra superimposed on the shadow of the first sacral. A lateral view in the same patient showed the fifth lumbar vertebral body to have slipped completely off the first sacral. This condition was present in an 18 year old girl. Deformity had been noticed for 7 years and low back pain had been present for 2 years. A spinal fusion was done of the fourth lumbar to the first sacral. When last seen 6 years after operation the patient was employed as a cashier, her fusion mass appeared solid and she was without symptoms. The deformity, of course, remained the same.

coronal plane or nearly so, and an early development of osteophytic lipping. Spina bifida occulta is common. Unilateral sacralization especially makes motion eccentric. The enlarged transverse process causes narrowing and lengthening of the lumen of the bony canal through which the anterior root of the fifth nerve must pass, increasing the possibilities of irritation.

EXAGGERATED LUMBOSACRAL ANGLE

The axis of weight-bearing of the body passes anterior to the lumbosacral juncture, causing a constant shearing strain which is proportional to the obliquity of the superior surface of the first sacral vertebra with the horizontal. This angle averages around 43 degrees, but may be much more and sometimes reaches nearly a right angle (Fig 4). In these cases one often finds at operation a deepening of the posterior articular fossæ and the inferior articular facets of the fifth lumbar

vertebra subluxated into them. An accentuated angle puts muscles and ligaments under great and constant strain, and by reason of the upward displacement of the posterior articular processes of the first sacrum toward the inferior intervertebral notches of the fifth lumbar vertebra the lumbosacral foramina are encroached upon (Fig 4). This has been demonstrated on the cadaver by Danforth and Wilson and is seen in lateral roentgenograms. Likewise, a greater proportion of the superincumbent weight must be borne by the posterior spinal elements, ill prepared to receive it. There is an associated narrowing of the posterior portion of the intervertebral disc which, as mentioned by Ferguson, is not an atrophy but merely a

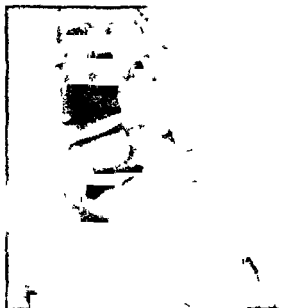


Fig 8 A narrow intervertebral disc between the fifth lumbar and the first sacral vertebra in a 54 year old female whose complaint was that of low back and bilateral sciatic pain of 5 years duration. Note how small the lumbar sacral intervertebral foramen is compared with those above.

phase in anteroposterior motion. This can be demonstrated by taking lateral roentgenograms in extreme flexion and in extension. Sometimes true atrophy of the disc is present.

In 28 European specimens Mitchell found that the average inclination to the horizontal of the upper surface of the first sacral body was 41 degrees and the average inclination of the last lumbar vertebra in the same specimens was 19 degrees. This is one reason why fusing the fifth lumbar vertebra to the sacrum strengthens the spine and lessens muscular and ligamentous strain.

SPONDYLOLISTHESIS

Spondylolisthesis was described by Herbinneau in 1782. The term derived from the Greek meaning "gliding of a vertebra" was first used by Killian in 1852. In 1892 Neugebauer collected 101 specimens showing the deformity. He ascribed the condition to lack of fusion between two centers of ossification existing in each lateral half of the neural arch. It most commonly affects the fifth lumbar (Figs 6 and 7). Between 1914 and August 1936, 104 patients had a spinal fusion at the

New York Orthopaedic Dispensary and Hospital because of low back pain resulting from this condition. We have found in all these a failure of fusion in the lamina between the superior and inferior articular processes, usually bilateral. The osseous portions are connected by fibrous tissue. This has, of course, been repeatedly seen and reported on museum specimens and cadavers and its congenital nature cannot be doubted. As has been pointed out by Willis, no callous formation is seen, which precludes fracture. We have one patient of whom roentgenograms taken in early childhood revealed a defect in ossification of the lamina of the fifth lumbar vertebra without slipping (prespondylolisthesis) and another series of roentgenograms of the same patient taken several years later showing a marked anterior displacement of the vertebral body. Anterior slipping probably is more often due to gradual stretching of the fibrous defect in the lamina rather than sudden rupture.

Sixty-two patients having spondylolisthesis and one having prespondylolisthesis (Figs 4 and 5) were found among the 800 treated for low back pain in this clinic during 1934. This represents new patients received during the year and "hold overs" from preceding years. However, in 1,157 consecutive new patients entering the clinic with low back and sciatic pain, 3 had prespondylolisthesis and 44 spondylolisthesis—a combined percentage of 4.1. Willis reported congenital defects in the neural arches in 4.28 per cent of 748 skeletons in a comparable racial group. It is surprising to see that the apparent combined percentage of prespondylolisthesis and spondylolisthesis in individuals having low back pain is no higher than the average incidence for this congenital defect. On a few occasions we have found at operation a fibrous defect in the lamina between the superior and inferior articular processes that had not been observed in roentgenograms of that area. This failure to detect by roentgenogram all cases of this defect may account for its apparently low incidence in patients having low back pain.

As demonstrated in the dissecting room and at operation the posterior elements of the defective vertebra are underdeveloped,

hypermobile, and the attached ligaments attenuated so that they are poorly prepared for the mechanical disadvantages associated with anterior displacement of the vertebral body. An exaggerated lumbosacral angle and spina bifida occulta are commonly found with spondylolisthesis.

DEGENERATIVE CHANGES IN THE LUMBAR SPINE

The spine is one of the first organs of the body to show the degenerative changes of increasing tissue age. These changes are most manifest in the lumbar spine, particularly at its junction with the sacrum, and it is here, for reasons already stated, that anatomical changes are most likely to cause symptoms. Lessened elasticity is one of the earliest degenerative changes coming in the normal life history of the intervertebral disc. This magnifies the mechanical shocks to which the bony surfaces are exposed.

In 3,000 routine examinations of the spine at autopsy, Schmorl found fissuring of the cartilaginous plates allowing herniation of the nucleus pulposus into the spongiosa in 38 per cent. This, of course, narrows the intervertebral discs (Fig. 8) in addition to decreasing their shock-absorbing power. The narrowed discs disturb the relationship of the articular surfaces of the posterior joints, and osteoarthritis results.

Beadle writes that herniation of the disc substance posteriorly into the spinal canal was found in 15.2 per cent of 368 spines. None was seen under 30 years of age and most were in individuals over 50. He does not mention what percentage of these occurred in the lower lumbar spine.

That such a condition could cause sciatica and low back pain was first mentioned in this country by Goldthwait in 1911, and almost simultaneously by Middleton and Teacher in Scotland. Their work has lately received ample confirmation by Mixter and his co-workers, who have reported operating upon 23 patients in whom a herniation of disc substance posteriorly had been accompanied by sciatica and low back pain. All but one obtained immediate and complete relief from sciatica when the offending herniation was

removed. The follow-up period has been too short to testify as to the permanency of the relief. The age, history, and physical findings differed in no way from what one commonly finds in patients having a severe so-called lumbosacral strain or unstable fifth lumbar vertebra. All, however, had an elevation of spinal fluid protein and most a definite shadow defect after injection of lipiodol into the subarachnoid space. There have been more recent reports of intervertebral disc herniations unaccompanied by an elevation of spinal fluid protein, but an elevation is much the more common finding, being present in 36 of 39 recently reported cases (Hampton and Robinson). The only other significant roentgenographic finding was a thinning of the intervertebral disc at the level of the lesion in 5 of the 23 patients. At operation the disc protrusion was found between fourth and fifth lumbar, 15 times, fifth lumbar and first sacral, 5 times, third and fourth lumbar, twice, and first and second sacral, once. Posterior herniations of the disc between the fourth and fifth lumbar usually press directly upon the fifth lumbar nerve root. This lesion is not uncommon, for in 18 months 12 cases were seen and patients were operated upon at the Massachusetts General Hospital.

DIAGNOSTIC SPINAL PUNCTURE IN LOW BACK PAIN

It was with the work of Mixter and his colleagues in mind, and with the hope that more light would be thrown upon the etiology of sciatica and low back pain, that now all patients entering the New York Orthopedic Hospital for operative work because of this condition have a spinal fluid examination. Particular attention is paid to the protein content. In 12 of the first 50 patients it was found to be above the commonly given upper limit of 42 milligrams per 100 cubic centimeters for the method used. In one the reading was 100 milligrams per cubic centimeter and the globulin was 2 plus. This turned out to be due to a cord tumor and will be discussed later. In 11 the protein varied from 43 to 64 milligrams and averaged 50. The spinal punctures were done between the third and fourth lumbar. In Mixter's cases, with proved disc pro-

by anatomists for the buttocks and lower extremities

It has been established that motor nerves can possess protopathic sensations so that stimulation of such a nerve causes a definite, diffuse, and ill defined pain. A simple adequate explanation for that major portion of sciatica and its accompanying phenomena not explainable on a referred basis is that irritation of the fifth lumbar nerve in its intervertebral foramen, or in the spinal canal, causes a neuritis, lowers its threshold to stimuli, and sends protopathic sensations out along its motor branches. Sensory branches within the nerve which go to the lateral aspect of the leg are also stimulated, accounting for the more superficial nature of the pain and the occasional sensory changes in that area. If stimuli are strong enough they may spill over into the other branches of the sciatic nerve, resulting in such a phenomenon as pain in the lateral plantar aspect of the foot.

After leaving the intervertebral foramen the posterior division of the fifth lumbar nerve turns backward and divides into branches which supply the lumbosacral articulations, supporting ligaments and muscles, and enter into the posterior sacral plexus along with the sacral nerves. While in the intervertebral foramen it is subject to the same irritation as the anterior division which forms part of the sciatic nerve. Another source of irritation is the lumbosacral joints and their supporting muscles and ligaments. That these things may be so is suggested by the disappearance of pain in this area on fusion of the fifth lumbar vertebra to the sacrum. Pull of a spastic gluteus maximus upon its origin from the posterior sacro iliac and sacrotuberous ligaments supplied by the posterior sacral plexus, may be a third source of pain. This is demonstrated by the sudden relief from this as well as sciatic pain which may follow a posterior Smith Petersen incision (Heyman).

DIAGNOSIS

The symptom complex often designated as "low back trouble" occurs most commonly between the years 20 and 50. In 600 consecutive patients entering our dispensary with this complaint the average age of the females was

35 and of males 37. Most of these patients had had symptoms for several years. Among females many dated their trouble as coming on during pregnancy or following childbirth. Both sexes were wont to have their initial symptoms in that decade between 25 and 35 years when muscles begin to lose their tone, yet the individual fails to appreciate that he can no longer go suddenly from his now more sedentary ways into strenuous physical efforts without suffering the consequences. Others may not develop symptoms until about the fifth decade of life when degenerative changes such as osteoarthritis so often become clinically noticeable. In this group of 600, 42 were less than 20 years of age and only 18 over 60. A disproportionate number of the former had spondylolisthesis, a condition which may produce a noticeable deformity sufficient to cause the patient to seek medical counsel even before symptoms appear. Females slightly outnumbered males in this group, most writers, however, report more males than females.

A single definite traumatic accident may initiate symptoms, but more often the onset is insidious with exacerbations following severe or sudden back strain. First symptoms are usually muscle fatigue and an ache in the low back area radiating out over the sacro iliac joints and into the buttocks. Back stiffness is a morning complaint, and low back pain is experienced on sudden unguarded movements or spinal movements of considerable range. Lifting, coughing, and straining are painful. In many backache is accentuated by the presence of a focus of infection else where in the body and in some by damp weather. Menstruation in women and chronic inflammatory conditions in the pelvic region may increase the pain. The patient feels best when lying on a firm, unsagging surface. Sciatica may not be present at the onset. Occasionally, however, it is the only symptom and it is the common finding in severe and chronic cases. A lateral list of the trunk (sciatic scoliosis), either contralateral or ipsilateral, may be present. The former is twice as common as the latter. A description of the symptoms and signs in the lower extremity has already been given. Pain in the lower extremity may be accompanied by a con-

tracted tensor fasciæ latæ sufficient to cause an abduction deformity of the hip

This syndrome is found in both active and sedentary people and in all types of body build, but is more common in those of herbivorous build, probably because they are more subject to lumbosacral anomalies and degenerative changes in the spine

Poor posture is a common finding, especially when the patient is of the slender type. Lumbar lordosis is variable, being entirely eliminated in some acutely painful backs, whereas more chronic cases may show increased lordosis. Motion of the lumbar spine is limited, as a rule, by pain and muscle spasm. Tenderness may be present in the iliosacral-lumbar angle, over the fifth lumbar spine, and most commonly in that area under which lies the origin of the gluteus maximus muscle, the posterior sacro-iliac ligaments, the joint itself and the posterior sacral nerve plexus

Tests that produce motion in the lumbosacral joints cause pain as a rule. Lasgue's sign stretches the sciatic nerve. The only so called sacro-iliac tests which do not move the lumbosacral joints too are springing of the joints by compression of the iliac wings, and pressure over the symphysis pubis

DIFFERENTIAL DIAGNOSIS

Primary myofascitis Probably prolonged irritation of the sciatic nerve will produce a myofascitis in the muscles supplied by it. Certainly tenderness on squeezing the calf muscles is a common finding in individuals having sciatica but no apparent focus of infection or an arthritic diathesis

However, one often finds a patient who was symptom free until he developed an acute infection such as tonsillitis. He then had back pain and sciatica, accompanied by fascial and muscle tenderness in back, buttock, and thighs, which cleared up shortly after elimination of the acute focal infection. Here is a case of toxins making their presence known at the point of least resistance. Such a patient may have an unstable lumbosacral mechanism whose reserve margin has been broken down by the addition of a toxic load. It is more helpful to think of the latter group as cases of primary myofascitis and concentrate one's

efforts on the elimination of the infectious process

Fascial planes may be likened to joints allowing muscles to glide. If actual inflammation exists between these surfaces adhesions form causing pulling upon nerves which pass through the fascia into the muscle. Hence a chronic myofascitis quite resistant to treatment may develop. Patients so afflicted are poor subjects for spinal fusion even though their condition is aggravated by an unstable fifth lumbar vertebra

Spondylitis ankylopoietica (Marie-Strumpell type) This is a disease which in its early stages consists of an inflammation of the posterior articulations and ligaments of the spine. Later they undergo ossification. Golding has well shown that even before there is roentgenographic evidence of involvement of the vertebrae such evidence is present in the sacro-iliac joints. Two of the 681 patients upon whom spinal fusions were done for an unstable fifth lumbar vertebra at the New York Orthopedic Dispensary and Hospital later went on to develop this type of spondylitis. At the time of fusion they were young adult males with history and physical findings typical of that commonly associated with an unstable fifth lumbar vertebra. Examination of the pre-operative roentgenograms did, however, show arthritic condensation of the sacro-iliac joints and a slight furring of the lumbosacral joints. The above story, plus a history of transient synovitis of some of the joints of the extremities several years previously, are the common early findings. Later in its development this disease presents a typical picture easy to diagnose correctly

Osteo-arthritis As previously stated, this condition is one of the causes of low back and sciatic pain. When localized to the lumbosacral area the treatment differs in no way from that to be outlined. If generalized osteo-arthritis of the spine exists, treatment, particularly operative, must undergo drastic modification. Roentgenograms and the presence of generalized back pain make diagnosis of this condition simple

Sacro-iliac strain As early as 1863 Hilton wrote that sciatica might be caused by sacro-iliac or lumbosacral disease and that differen-

tiation of the two conditions was almost impossible. He described typical cases of low back and sciatic pain which he attributed to disease in the sacro iliac joint. He treated them by rest much as it is done today.

In 1905 Goldthwait and Osgood stated that this syndrome might be due to sacro iliac relaxation, subluxation, or arthritis. This conception of the etiology became extremely popular and still has its adherents. Some feel that sciatica is referred pain from the ligaments of the sacro iliac joint, others that the fourth and fifth lumbar nerve trunks are irritated as they lie in close proximity to the anterior aspect of the joint. Earlier in the paper reasons for believing that sciatica is only in small part, if at all, a referred pain are given. We have case records in which a large abscess forming over the anterior aspect of the sacro iliac joint, secondary to tuberculosis or osteomyelitis within has caused sciatica. However, even assuming that a minute subluxation of the sacro iliac joint takes place, it is difficult to believe it would irritate the lumbosacral cord, which is held loosely attached to the anterior aspect of the sacral body with its fourth lumbar root, and occasionally the fifth lumbar, lying over only the inferior angle of the joint (Danforth and Wilson).

The sacro iliac joints allow but a few degrees of rotary and sliding motion and have the strongest ligamentous support of any joints in the body. They are made for stability, not mobility. It is hard to conceive of low back pain being the result of ligamentous strains or minute subluxations at this joint. Such a conception is particularly difficult to entertain when one sees tuberculosis, chronic arthritis, or gross subluxation of a sacro iliac joint following severe injury unassociated with a great deal of pain. It is surprising that the symptom complex just discussed should be attributed to strain of these joints when in their immediate vicinity a mechanical set up exists which theoretically can readily account for the symptoms produced. Probably because non-operative treatment devised for sacro iliac strain is of equal therapeutic value for lumbosacral strain, and the various diagnostic tests aimed at eliciting symptoms in

one are almost as effective in producing symptoms in the other, the misconception has been long lived.

In operative fusion of the sacro iliac joint the posterior attachments of the gluteus maximus and deep fascia are usually widely stripped from the posterior iliac crests. Heyman has found that this procedure alone will sometimes give a complete cure from sciatica. Bed rest, immobilization and physiotherapy, which accompany operative treatment, have also proved beneficial in low back pain, hence the fallacy of sacro iliac strain has not been as quickly exposed as it might have been. The writer does not consider pain to be of sacro iliac origin unless there is evidence of disease or gross displacement of that joint. The depth, obliquity, irregularity of joint surfaces, and overlying shadows make any roentgenographic interpretations difficult and subject to a large margin of error.

Coccygodynia Falls that injure the coccyx may cause lumbosacral injuries also. Perhaps because of this many have felt that pain due to an unstable fifth lumbar vertebra may be referred to the coccyx. This has been disproved as a result of the careful studies of Duncan. On several occasions lumbosacral fusions have been done at this hospital for a combination of symptoms from these two conditions. The low back and sciatic pain has disappeared but the coccygodynia has remained until finally cured by coccygectomy.

Coccygodynia is usually accompanied by a definite history of direct trauma to the coccyx. Males are seldom afflicted as their narrow sacrosacral notches permit the coccyx to be tucked in between the ischial tuberosities, and to be protected from falls in a sitting position. Pain is worse when sitting or on rising from a sitting posture. It is lessened by sitting on an air cushion ring or contracting the glutei while sitting erect, thus raising the coccyx off the chair. External and rectal palpation will reveal tenderness, and there may also be increased mobility and angulation of the coccyx on the sacrum. When arthritis is present at the sacrococcygeal joint minor traumas often cause coccygodynia. Roentgenograms may show an unusually long or unprotected coccyx, osteoarthritis, acute angulation and, more

rarely, a fracture dislocation. Variation in the number of coccygeal vertebrae, and a transitional first coccygeal vertebra are common.

Fractures of the spine Compression fractures of the vertebral bodies and fractures of the transverse processes or posterior elements of the spine occasionally produce a syndrome resembling that of lumbosacral strain. Roentgenograms and history should enable one to differentiate the two.

Spinal cord tumors Spinal cord or cauda equina tumors are the most difficult problem in the differential diagnosis of low back pain. If the patient's pain is greatest when recumbent, even if on a firm unsagging surface, is particularly accentuated by coughing or pressure upon the internal jugular veins, and both sensory and motor disturbances are present, cord tumor must be suspected. If a tumor is present there will be an increase in spinal fluid protein, a complete or partial block, and a defect in the lipiodol shadow.

While low back pain in the majority of patients is satisfactorily explained by the mechanical and degenerative changes just discussed, it must be remembered that a similar syndrome can be produced by infectious diseases and new-growths involving the lumbosacral area of the vertebral column. Symptoms in these cases are caused by inflammation and toxic absorption as well as the mechanical disturbance produced. Tuberculosis, chronic osteomyelitis, and metastatic tumors particularly must be kept in mind. These should not be difficult to rule out if the examination has been thorough and roentgenograms taken.

Prostatitis and vesiculitis in the male, malposition, new-growths, and inflammatory conditions in the pelvic organs of the female, and rectal pathology in both sexes must be considered. A differential diagnosis of these conditions is not within the scope of this paper. I do not believe that the picture of low back pain and sciatica is commonly caused by intrapelvic pathology.

NON-OPERATIVE TREATMENT

A Mild cases Exercises designed to improve body posture and to strengthen the muscles of the lumbar spine and abdomen are

beneficial. Exercises should not be carried to the point where strain and its accompanying symptoms are produced, and for this reason they are impractical while symptoms are severe. Patients are to be cautioned against activities that cause back pain. Women addicted to high heels should replace them with low heeled shoes because of the adverse action of the former on general body posture.

Heat followed by massage is helpful. For economic reasons it is well to instruct the patient and some other member of the family in the manner this should be carried out so that they may do it at home daily.

Elimination of bed sag by placing a fracture board between the mattress and bed springs is of great value and, next to postural exercises, gives more relief than any measure to be considered when symptoms are mild.

Foci of infection in all cases should be searched for and, if possible, eliminated.

B Cases of moderate severity These patients should, in addition to the above treatment, be given a supporting belt, corset, or brace. It is to be noted that while providing much relief from back pain, external supports seldom lessen sciatica to as great a degree. In women a stiff corset containing little or no elastic, to which has been attached a back pad to fit into the "small" of the back, is satisfactory. Men may be supplied with a lumbosacral belt having a similar back pad. The belt should be 6 or 7 inches wide for an adult and have perineal straps.

For patients having considerable pain or an accompanying generalized spinal arthritis, a light Taylor back brace gives more support. If arthritis is confined to the lumbar spine a brace about 11 inches in height is sufficient, but if the dorsal spine is also involved it should extend from the buttocks to the first dorsal vertebra.

External supports should be discarded gradually when severe symptoms disappear, for if prolonged they weaken the very muscles that support the lumbar spine.

C Severe cases If the onset of pain is acute, recumbency on a firm bed, with a brace such as described applied to the back, and, if sciatica is present, adhesive moleskin traction to the legs, is indicated. Daily baking and

light massage should be given. Sedatives are sometimes required.

Much the same treatment is applicable to chronic cases if operative work is contra-indicated or refused.

Prolonged suffering which has failed to respond to treatment leads, in many patients, to the development of anxiety tension syndromes and neuroses. For such, a full explanation of their condition plus positive assurance that they can be made well, when combined with effective treatment is helpful. Symptoms are likely to be exaggerated and convalescence prolonged in patients receiving compensation. This is particularly true in the older and the less ambitious and must be considered in any plan of treatment.

Epidural injections. We have not found epidural injections of novocain of sufficient value to warrant their continued use.

Manipulations. Forceful manipulations of ten harm and are never warranted. Manipulations may be used routinely when gently done. One seldom sees a dramatic cure but often the patient's suffering is temporarily allayed. It is probable that some who are given relief have had a subluxation of one or both posterior articulations which have slipped back in place during the maneuvers.

OPERATIVE TREATMENT

Tensor fasciæ latæ fasciotomy. In 1920 Percy W. Roberts of New York, found that sciatica could be relieved by releasing the tensor fasciæ latæ, gluteus medius, and the anterior portion of the gluteus maximus from their origins and allowing them to slide down and reattach at a lower level on the ilium. He did not publish his results. In February, 1934, Ober cut the fascia tensor over and adjacent to the tensor fasciæ latæ muscle and found it relieved the patient of low back and sciatic pain in a fair percentage of cases having what he considered a contracted fascia. The test devised by Ober to detect contracture of the iliotibial band and fascia lata and his operation for correction of the condition, are described in articles by him (24, 25).

Our incomplete knowledge makes it difficult to say what is or what is not normal fascia in the living adult. Certainly it varies a great

deal in thickness and tautness from individual to individual. Likewise, the number and size of intermuscular fibrous bands extending from the fascia is variable. Generally the fascia is most taut and thick over the anterior portion of the tensor fasciæ latæ. After severance the cut edges of the fascia spread from 1 to 2 inches. In our cases the fascia when examined microscopically has appeared normal.

No satisfactory explanation has been given as to why a fasciotomy sometimes brings relief from sciatica and low back pain. We know that many patients have had partial relief from a fasciotomy and then complete relief on doing a lumbosacral fusion, the reverse is also true. Lumbosacral fusion cures completely and permanently a much higher percentage than does fasciotomy. However, there are cases such as this. A 24 year old man entered our hospital with an extremely painful low back and left-sided sciatica and an ipsolateral list of the trunk. Roentgenograms showed a posterior displacement of the fifth lumbar vertebra. A lumbosacral fusion gave complete relief and he returned to his work as a house painter 4 months after operation. Three years later he had a sudden onset of right sciatica and low back pain and again an ipsolateral list of the trunk. Non-operative measures pursued for several weeks did not help at all. A right fasciotomy was then done, relief was immediate and the patient was still symptom free 11 months after operation. There are no clear cut signs which tell us that this patient's symptoms are due to a tight fascia and will be relieved by a fasciotomy or that another patient's symptoms are due to an unstable fifth lumbar vertebra and will be cleared up by a lumbosacral fusion. The Ober test is often positive in individuals who have never had sciatica and is particularly likely to be so in people of herbivorous build of middle age or beyond. It may be positive after a spinal fusion that has cured the patient completely and may remain positive even after a fasciotomy that has had the same happy ending. When sciatica is unilateral it is, however, usually more positive on the involved side. The writer has seen patients with sciatica and a strongly positive Ober sign both of which have disappeared completely in

the course of 1 or 2 weeks of non-operative treatment. Releasing the gluteus maximus from its attachments to the posterior aspect of the sacro-iliac joint and iliac crest will free one of sciatica much as a fasciotomy does. Signs such as an absent Achilles reflex, positive Lasegue's test, tenderness and muscle atrophy may disappear, as well as symptoms, following a fasciotomy.

From these facts one can assume that the Ober sign is not necessarily positive because of a tight fascia but may be due to muscle spasm. Certainly fascia is not tissue that can contract in a few days, then return to normal in a few more days, and that is the supposition one would have to make in ascribing it to the Ober sign. When muscle spasm and therefore shortening has existed for a long period of time and has been accompanied by inflammation, one can conceive of fascia undergoing actual contracture. Since inability to adduct the thigh, and a fascia that feels definitely tight may be present even when sciatica is not, one cannot place a great deal of reliance in the Ober test.

A fasciotomy lessens the tension of the gluteus maximus and fascial covering by allowing origin and insertion to follow more nearly a straight line course. One can conceive of this affecting sciatica and low back pain in three ways, and perhaps all three play some part in the picture: (1) strain upon the lumbar spine becomes less, (2) tension exerted upon the origins of the gluteus maximus and fascia lata is decreased, (3) any pressure which a spastic gluteus maximus muscle might impose on the underlying sciatic nerve is lessened. Whether this is the manner in which a fasciotomy interrupts the mechanism by which pain is produced is conjectural. However, I believe that one must still look to the lumbosacral spine to find the primary etiological factor in this syndrome.

Up to September 1, 1936, this operation had been done upon 79 patients at the New York Orthopedic Dispensary and Hospital. In 9 the fasciotomy was bilateral, and in 2 it was repeated because of failure to obtain relief at the first operation. These patients varied in age from 14 to 80 years. Forty

TABLE I—TYPE OF LIST AND RESULT OF OPERATION

	Direction of trunk list				
	Ipsilateral	Contralateral	Alternating	Total	Per cent
Complete or more than 90 per cent relief	2	4	2	8	15
75 per cent relief	0	4	0	4	19
50 per cent relief	3	0	0	3	14
Less than 25 per cent or no relief	1	5	0	6	29
Total number of patient	6	13	2	21	

were females, averaging 36, and 39 were males averaging 39 years of age.

All of the patients had severe sciatica which had not proven amenable to non-operative treatment. In 34 the sciatica was on the right side only at the time of operation, in 30 on the left, and in 15 it was bilateral. However, in the latter pain was usually much worse on one side than the other. The length of time symptoms had been present varied from 4 weeks to 23 years and averaged $4\frac{1}{2}$ years. Fifty-seven of the 79 patients had fatigue or fatigue and pain across the back at and above the level of the lumbosacral junction in addition to sciatica.

Twenty-one (27 per cent) of the patients had a definite list of the trunk, so called sciatic scoliosis. The type of list and the operative results in this group are shown in Table I.

A comparison of these results with those listed in groups I and II below shows no significant difference in the results obtained. Theoretically this might seem a favorable group, as in them the Ober test is more likely to be strongly positive.

Excluding all patients who had not been followed for more than 2 months, the remainder were divided into 3 groups.

Group I. These patients had only a fasciotomy. The average follow-up period was 8 months. In this as in the other groups, when relief was obtained it sometimes came with dramatic suddenness, but more often while considerable immediate diminution in pain was obtained several weeks elapsed before it was completely gone. Sciatica usually disappeared before back pain. Occasionally

TABLE II—INVOLVEMENT AND RESULTS

	Sciatica only		Sciatica and back pain	
	No.	Per cent	No.	Per cent
Complete or more than 90 per cent relief	6	67	7	33
Complete relief from sciatica but still some back pain	0	0	5	24
50 to 75 per cent relief	1	11	6	29
Less than 25 per cent or no relief	2	22	3	14
Total number of patients	9		21	

the former would disappear completely and the latter remain. More commonly both were lessened, but the disappearance of back pain would be less complete and would take longer.

Analyzed in another way, in the entire group 13 (43 per cent) were well, 12 (40 per cent) had at least 50 per cent relief from symptoms, and 5 (17 per cent) were not materially improved (Table II). These results are quite similar to those of Ober, who in 42 patients reports 23 (55 per cent) as well, 10 (24 per cent) as improved, and 9 (21 per cent) as unimproved. However, our results are not as sanguine as this group might indicate, for in the analysis one must consider at least the 5 patients in group III in whom a period of 1 month elapsed before the spinal fusion.

Of special interest in this group is one patient who had a fasciotomy on one side with complete relief, but 1 year later returned with sciatica on the opposite side. This, too, was completely cleared up by a fasciotomy.

Several of the failures in this and the other groups had some relief immediately after the operation, but symptoms returned as soon as they again became active.

Group II. There were 20 patients who previously had had a spinal fusion, and in one case a sacro iliac fusion too, for relief from sciatica and back pain. In some the fusion had been done several years previously but more often but a few months had elapsed. In all of the cases shown in Table III, however, at least 2 months elapsed between the spinal fusion and fasciotomy. The average follow up period since fasciotomy was 11 months. In the majority of this group the remaining symptom after fusion was sciatica only.

TABLE III—RESULTS IN GROUP II

	Unilateral No.	Bilateral No.	Total	Per cent
Complete or more than 90 per cent relief	4	1	5	25
50 to 75 per cent relief	7	1*	8	40
Less than 25 per cent or no relief	4	3	7	35
Total number of patients	15	5	20	

*This patient had a bilateral fasciotomy with complete relief on one side none on the other. The latter was repeated four months later with a repetition of the failure. She has a definite pseudarthrosis in her spine now.

Of the 7 failures, one did have complete relief for 6 months, then a recurrence. His fusion has been explored and found solid. A complete sectioning of the piriformis muscle has also failed to bring relief from pain (Frieburg). In another patient symptoms returned suddenly after an absence of 16 months. Two had pseudarthroses repaired later and have obtained complete riddance of pain. One other has a definite pseudarthrosis clinically and by roentgenogram but has refused an attempt at repair.

Group III. In this group the fasciotomy was accompanied or followed by a spinal fusion. In 3, the operations were simultaneous and while all are well, one can draw no conclusion as to which procedure had the curative effect. The others are tabulated in Table IV.

Six of the above 9 patients have been seen at least 5 months after spinal fusion (first sacral to fifth lumbar). Four are symptom free while 2 have had no appreciable relief. One of the latter has recently had a pseudarthrosis repaired.

Lumbosacral anomalies present in this series of patients were essentially the same as those in which we have performed spinal

TABLE IV—RESULT FROM FASCIOTOMY, GROUP III

	Spinal fusion within one month after fasciotomy	Spinal fusion 2 to 13 months after fasciotomy Average period 5 months
Relief from sciatica but not back pain	1	1
Partial relief from sciatica none from back pain	1	2
No relief	2	2
Total number of patients	4	5

fusions except that none had spondylolisthesis. The lumbosacral angle was variable, ranging from 5 to 64 degrees and averaging 35 degrees. More often than not the angle was materially decreased by lumbar spasm and again increased after fasciotomy. Twenty-one (27 per cent) of the patients had roentgenographic evidence of arthritis elsewhere in the body, mostly the spine. It is doubtful whether this is greater than the average in any group of people of this age. However, patients with arthritic spines, while getting as much relief from sciatica, were less likely to get rid of back pain than the non-arthritics.

Significant is the fact that patients who had had sciatica for less than 1 year obtained far better results than those in whom symptoms had been present for a longer period. In this group were 17 patients. Eleven (65 per cent) obtained complete relief, in 2 (12 per cent) sciatica disappeared but back pain remained, 2 (12 per cent) were 50 to 75 per cent improved, 2 (12 per cent) unimproved. These were patients included in groups I and III.

SUMMARY

1 The ideal patient upon whom to do a fasciotomy is one whose predominating symptom is sciatica which has been present for less than 1 year and who shows no roentgenographic evidence of generalized spinal arthritis.

2 There are, however, patients with too extensive spondylitis to justify a spinal fusion in whom a distressing sciatica exists which has failed to respond to non-operative measures. The percentage of these patients who are relieved entirely or in part of their sciatica by a fasciotomy makes it a warrantable procedure.

3 The simplicity of this operation, its minor nature, and the fact that it can be done under local anesthesia make it applicable in many patients whose age and health contraindicate major operative procedures. Likewise, the short period of hospitalization (1 week) and disability enables one to perform a fasciotomy on patients who cannot afford to be economically shelved for the 3 to 5 months required by a spinal fusion.

4 I believe that anyone who has had low back pain and sciatica to a disabling degree,

as the writer has, will agree that a fasciotomy is worth while if only 50 per cent relief is obtained. In group I, that had this operation alone performed, 83 per cent were benefited that much or more.

5 The results of this operation are not as satisfactory as those of lumbosacral fusion, an operation that has well stood the test of time.

SPINAL FUSION

Fusion of the lumbosacral spine is done on the theory, now amply proved, that complete elimination of motion will cause cessation of inflammation existing in and around the articulations and intervertebral foramina and relieve supporting muscles and ligaments of a strain they have been unable to bear. We also believe that direct pressure does not produce a radiculitis when motion is not present. The remarkable ability of soft tissues to make an adjustment between themselves and their surrounding bony canal after changes caused by tuberculosis and spinal fractures has often been observed at autopsy.

The first spinal fusion performed at the New York Orthopaedic Dispensary and Hospital to relieve a patient of low back and sciatic pain was done in 1914 upon an adolescent girl having spondylolisthesis. From that date until August 1, 1936, this operation was done upon 681 patients. Three of these patients died, a mortality rate of 0.4 per cent. In 2 of the patients death was due to a *Streptococcus haemolyticus* septicemia secondary to wound infection. One death followed a postoperative pneumonia. In general the postoperative course of the patients has been as uneventful as one might expect of a clean appendectomy case in the average general hospital. The patients are recumbent for 6 to 8 weeks, wearing a Taylor back brace extending from the buttocks to about the tenth dorsal vertebra. Absolute immobilization of the spine by external means is impossible but a brace does prevent the more gross movements. After getting up activities may be increased gradually until the brace is discarded about 4 to 5 months after operation. A patient should be able to return to sedentary work within 3 months and to manual work within 4 to 5 months after operation.

The Hibbs type of spinal fusion which was used in all cases is too well known to require further description. However, it might be well to emphasize the following points: (1) It is essential that the cartilage from the posterior articulations be removed and the resultant spaces packed with bone chips. (2) The chips should be numerous and small. The smaller chips increase surface area, thereby hastening decalcification and revascularization. Also motion between individual particles is decreased. Here as elsewhere this is an important factor in insuring early and solid bony union. (3) Usually sufficient bone is obtained if one goes well up on the sacrum and uses the spinous process of the vertebra above the fusion area for additional chips. However, if the supply of bone seems inadequate, more may be obtained from the posterior crest of the ilium. (4) The posterior articulations immediately above the area to be fused must not be exposed as this may lead to a traumatic arthritis. (5) Care should be taken to see that the fusion mass does not impinge upon the lamina and spinous process of the vertebra above.

Before 1928 the fusion area usually extended from the first sacral to the fourth lumbar vertebra. Today for reasons to be shown later in this paper the fusion is of the fifth lumbar vertebra only to the sacrum, unless a spondylolisthesis or very definite degenerative changes or mechanical abnormalities exist between the fourth and fifth lumbar vertebra. Likewise, since about the same time we have routinely taken the spinous process of the vertebra above to reinforce the fusion area. Still more recently we have been using bone from the posterior crest of the ilium whenever the posterior spinal elements seem inadequate as a source of bone chips. For these reasons, and because today more care is shown in the selection of cases, our results are now better than is represented in the end result study given below.

It is difficult to get adequate follow up examinations on private patients, so only ward patients have been included in this study. All have been followed for a minimum period of 3 years. Many will have occasional aches for 3 to 9 months after operation, then

are completely free of symptoms. Others may be well for a period of several years, in 2 cases 10 years, then have a sudden recurrence. Roentgenograms of the latter will usually show a pseudarthrosis. It is well known that under non-operative treatment this syndrome commonly follows a wave like course with periods of relative quiescence. For these reasons I believe that 3 years is an absolute minimum period in which to follow a patient before drawing a conclusion as to the worth whileness of this operative procedure.

An attempt was made to determine the end results from non-operative treatment but the difficulties encountered in keeping contact with patients no longer having symptoms were too great to make this practicable. The literature contains no adequate statistical studies of the results obtained from non-operative treatment of this condition. As long as we must base opinions on impressions we are seldom in a position to advise spinal fusion before an effort has been made to secure relief by other means. At present about 1 in 15 patients treated at this dispensary for sciatica and low back pain has a lumbosacral fusion, and it is perhaps advised in 1 out of 10. It is well to remember when judging end results from spinal fusions that these were patients who had had severe symptoms. Many were unable to carry on their work, all were definitely handicapped. All had tried non-operative measures to secure relief. Many had been under the care of irregular practitioners as well as legitimate physicians and surgeons. All still suffered so much that they were willing to undergo a major operation and time-consuming convalescence in an effort to obtain a cure.

In this group are 195 patients who were followed for an average period of 5 years and 11 months. One hundred and seventeen were males and 78 females averaging 32 and 29 years of age, respectively. The extreme range of ages was 11 to 54 years. The length of time symptoms had been present before operation varied from a few weeks to 20 years and averaged 5½ years. It is to be noted that the age average in this group is considerably below that for patients treated without operation or by means of a fasciotomy.

One hundred and thirty-eight (70.8 per cent) obtained an excellent result. By this is meant that relief was complete or symptoms were confined to an occasional ache such as any one might have following prolonged physical effort. Usually a patient had some backache and occasional twinges of sciatica for 3 to 9 months after the operation. These postoperative aches are probably due to the prolonged period of bed rest and back immobilization or to secondary fascial adhesions and other inflammatory changes remaining after the primary causative factor has been removed. Nine of the patients had some roentgenographic evidence of generalized spinal osteo-arthritis, but in none were the symptoms from this source more than mild.

Fourteen (7.2 per cent) of the patients had 75 to 90 per cent relief, and this might be considered a good result. In analyzing this group in an effort to find why relief had not been complete, the following facts were disclosed:

a In one the fusion mass impinged upon the spinous process and vertebra above the fusion.

b In 4 patients pseudarthroses existed clinically and by roentgenogram.

c One patient had generalized migratory joint and muscle pains.

d One was an extreme neurasthenic, a diagnosis one dislikes to make but probably correct and the cause of continued symptoms in this case.

e This man had a markedly shortened lower extremity and recurrent chronic osteomyelitis of the femur. He was of poor physique and posture.

f There were 6 patients in whom no apparent reason for the incompleteness of relief was discovered.

Seventeen (8.7 per cent) of the patients had a 50 to 75 per cent lessening of their preoperative symptoms. Analyzing this group it was found that:

a Five had pseudarthroses clinically and by roentgenogram.

b Two more had had pseudarthroses repaired but did not obtain complete relief.

c This man had a wound infection which drained for 15 months.

d Three patients had generalized spinal and sacro-iliac arthritis. One of these was

completely relieved 5 years later by a fasciotomy.

e This man had a chronic prostatitis and an extensive pyorrhea.

f Several abscessed teeth were removed from this patient some years after operation. He complained of generalized joint aches and pains.

g In 4 patients I could find no apparent reason for the incompleteness of their relief.

Twenty-six (13.3 per cent) of the patients had little or no relief. As far as one can determine none of the patients was made worse. Of the 26 patients:

a Two had pseudarthroses clinically and by roentgenogram but refused repair.

b Nine had attempts made to repair their pseudarthroses. This group is described in more detail later.

c One woman should have had the fourth lumbar vertebra added because of an extremely acute angle and oblique articulations. She was an extremely nervous individual and inclined to neurasthenia.

d Nine patients had generalized spinal and sacro-iliac arthritis, often accompanied by obvious foci of infection such as teeth, sinuses, throat, and prostate.

e This patient had a tuberculous infection involving the intervertebral disc between the fourth and fifth lumbar vertebrae. This point of infection was not visible roentgenographically until several months after operation. The fusion was then extended to the second lumbar vertebra. The patient is symptomless today. In the 681 patients there were 2 others in whom a similar mistake was made.

f A woman whom several neurologists have diagnosed as having an adhesive arachnoiditis.

g A man who later developed a typical spondylitis ankylopoietica of the entire spine.

h It is now obvious that this patient's symptoms came from his dorsolumbar spine, where osteo-arthritis and a slight structural scoliosis existed, and there was no indication for a lumbosacral fusion.

i This patient was completely freed of his symptoms several years later by a fasciotomy. No reason for the failure of the spinal fusion was apparent.

The presence of generalized arthritis and of foci of infection has been listed as a reason for failure to obtain complete cure following spinal fusion, though the writer is well aware that he has not definitely proved that these are causative factors. But in view of the relative absence of these factors in those obtaining complete relief he feels that it is logical to assume that they are major reasons for the *continuance of symptoms in the presence of a solid fusion*.

From this analysis it can be seen that where one has not relieved a patient of his low back symptoms and sciatica, the patient has nearly always been ill chosen or a definite pseudarthrosis exists in the fusion area.

SELECTION OF PATIENTS UPON WHOM TO DO A SPINAL FUSION

The patients were divided into groups according to the types of anomalous and degenerative changes present. It was found that no essential differences existed in these groups as to the type or severity of symptoms present and the degree of relief obtained by fusing the spine. Patients having thin intervertebral discs between first sacral and fifth lumbar or fourth and fifth lumbar in whom the likelihood of a posterior herniation of the disc was greatest obtained as good results as as that secured for the all groups average. The only differences in the groups were that those having spondylolisthesis or a transitional fifth lumbar vertebra in which the fusion extended from the first sacral to the fourth lumbar had a higher percentage of pseudarthroses and a proportional rise in the number of failures. Age did not affect the incidence of pseudarthrosis. The results obtained were slightly better in young adults, but this was about proportionate to the greater incidence of generalized osteo arthritis and more frequent foci of infection in the older. Likewise, older patients had more difficulty in ambulating and in regaining their strength after operation. Spinal fusions in patients over 55 years of age are seldom warranted.

While there is no relationship between pre-operative roentgenographic findings and the results obtained at operation, it is generally the opinion of members of the New York

Orthopaedic Dispensary and Hospital staff that patients having spondylolisthesis, an atrophic intervertebral disc which is associated with an osteo arthritis, an abnormally acute lumbosacral angle, severe posterior displacement of the fifth lumbar vertebra, a transitional vertebra, or extreme asymmetry of the lumbosacral joints respond least well to non-operative treatment. At present we have no statistical evidence to support this, it being difficult to follow an unselected group of patients not operated upon over an adequate period of time.

Many clinics today are discovering an unusually high incidence of herniations of the intervertebral disc posteriorly in patients having sciatica. It is well therefore to do spinal punctures and, if necessary, lipiodol injections on all upon whom a spinal fusion is contemplated. As previously stated, there is reason to believe that arthrodesis of the spine to include the area with the involved disc is a good procedure. It will be interesting to see if patients with definite lipiodol evidence of disc protrusion are relieved by spinal fusion alone.

In the selection of patients the following points must be kept in mind: (1) Those having generalized spinal arthritis are much less likely to get a complete cure. However, if pain is severe and well localized it may be feasible to fuse such a patient with the understanding that a lumbosacral fusion does not rid one of pain in the upper lumbar, dorsal, or cervical spine. (2) A careful search for and, if possible, elimination of foci of infection should be made before the spine is fused. (3) Conditions such as spinal cord tumors, tuberculosis, spondylitis ankylopoietica (early stages), and the possibility of causative factors higher in the spinal column must be kept in mind.

PSEUDARTHROSES

In 195 patients having lumbosacral fusions and followed after operation for a minimum period of 3 years and an average of 5 years and 11 months, there were 25 (12.8 per cent) in whom pseudarthroses were demonstrated at subsequent operations. An additional 11 (5.6 per cent) had roentgenographic and clinical evidence of pseudarthroses and 5 (2.6

SITES OF PSEUDARTHROSES

Fusions of the first sacral to fourth lumbar and first sacral to third or second lumbar	{	1 pseudarthrosis between first sacral and fifth lumbar only
		7 pseudarthroses between fourth and fifth lumbar only
		11 pseudarthroses between both fourth and fifth lumbar and first sacral and fifth lumbar
		1 pseudarthrosis between the third and fourth lumbar

per cent) very definite roentgenographic findings but no symptoms, making a total of 21 per cent of the whole group. Significant is the fact that only 6.2 per cent of the 80 fusions that extended from first sacral to fifth lumbar had pseudarthroses, while in the 93 going from first sacral to fourth lumbar and the 22 going from first sacral to third lumbar or second lumbar, the incidence was 31.2 per cent and 31.6 per cent, respectively. If one excludes from the latter two groups patients having spondylolisthesis, the incidence is 28.8 per cent. This is still 4.6 times as many failures of fusion as when the area arthrodessed goes from the first sacral to the fifth lumbar only. In spondylolisthesis the posterior elements are underdeveloped and very mobile, making fusion difficult. In the 42 patients having this condition 35.7 per cent had pseudarthroses proved at operation or revealed in roentgenograms.

The sites of pseudarthroses in cases proved at operation is shown in the chart above. A few of these were not visible roentgenographically but the patients were operated upon because of clinical findings. The 5 with fusions of first sacral to the fifth lumbar of course had pseudarthroses at that site.

Of the 25 patients who had attempts made to repair the pseudarthroses 11 (44 per cent) had complete relief from symptoms, though 3 did so only after a second repair.

Five (20 per cent) had 50 to 90 per cent relief. Two of these later obtained complete relief from a fasciotomy. One had a generalized spinal arthritis and one recurrent chronic

osteomyelitis of the femur in a greatly shortened lower extremity.

Nine (36 per cent) failed to be benefited by the repair. In 2 of these a pseudarthrosis is still evident roentgenographically, in 7 the fusion appears solid. It is to be remembered, however, that it is difficult to tell by roentgenogram whether or not a repair is solid. Of the latter 7, 1 has since been relieved completely by a fasciotomy, 2 have generalized spinal and sacro-iliac arthritis, and in 4 I can find no reason for continued symptoms.

The high incidence of pseudarthroses, as well as the difficulties encountered in trying to effect a repair, is discouraging. Until about 1928 it was customary to extend the fusion from first sacral to the fourth lumbar routinely, a practice now given up for obvious reasons. Certainly all cases of spondylolisthesis and many others would benefit by the addition of small bone chips from the posterior crest of the ilium and this is now being done often. Great care should be taken in removing the articular cartilage and filling the resultant spaces with bone chips. In repairing a pseudarthrosis the fibrous tissue must be removed from the crack and bone chips packed in. In addition, attached chips should be turned up over the entire fusion area, insuring a wider band of attachment of the newly formed bone to the old, for they will differ in architecture and therefore represent a point of weakness for several months.

CONCLUSION

Low back pain and sciatica are commonly due to an unstable fifth lumbar vertebra which has placed upon supporting muscles, ligaments, and joints, a load they are unable to carry. This instability is further increased by the congenital anomalies and degenerative changes common to this area of the spine.

The majority of patients will obtain sufficient relief from the non-operative measures outlined to make operation unwarranted.

Tensor fasciæ fasciotomy is a useful adjunct to our therapeutic armamentarium and is indicated in selected cases. It is well not to be too positive of its curative effect until several more years are added to the period of observation of patients after operation.

Of the operative measures a lumbosacral spinal fusion is the most satisfactory and is indicated in about 10 per cent of the patients. Improved operative technique and better selection of patients should enable one to raise the percentage of cures definitely above that found in the group presented here.

REFERENCES

- 1 BEADLE, O A. The intervertebral discs. Medical Research Council Special Report. Series No 161. London H M Stationery Office 1931.
- 2 BRILSFORD J F. The Radiology of Bones and Joints. Baltimore: William Wood & Co 1934.
- 3 DAINFORTH M S and WILSON I D. The anatomy of the lumbosacral region in relation to sciatic pain. *J Bone & Joint Surg* 1925 7 109-160.
- 4 DUNCAN G A. Personal communications.
- 5 FERGUSON A B. The clinical and roentgenographic interpretation of lumbosacral anomalies. *Radiology* 1934 22 548.
- 6 FRIEBERG A H and VINKE, T H. Sciatica and the sacro-iliac joint. *J Bone & Joint Surg* 1934 16 126-136.
- 7 GOLDING F C. Spondylitis ankylopoietica. *Brit J Surg* 1936 23 484-500.
- 8 GOLDTHWAIT J E. The lumbosacral articulation: an explanation of many cases of lumbago, "sciatica" and paraplegia. *Boston M & S J* 1911 164 365.
- 9 GOLDTHWAIT J E and OSGOOD R B. A consideration of the pelvic articulations from an anatomical, pathological and clinical standpoint. *Boston M & S J* 1909, 152 593-634.
- 10 HEYMAN C H. Thoughts on relief of sciatic pain. *J Bone & Joint Surg* 1934 16 889-894.
- 11 HIBBS R A and SWIFT W E. Developmental abnormalities at the lumbosacral junction causing pain and disability etc. *Surg Gynec & Obst* 1929 48 604-612.
- 12 HILTON J. Rest and Pain. 2d ed. New York: William Wood & Co 1829.
- 13 JOHNSON R W JR. Posterior luxations of lumbosacral joint. *J Bone & Joint Surg* 1934 16 867.
- 14 JUNGHAANS H. Die Spondylolisthese in Roentgenbild. *Fortschr a d Geb d Roentgenstrahlen* 1930 41 239-45.
- 15 KIMBERLEY A G. Low back pain: its etiology, diagnosis, treatment. *West J Surg* 1935 43 609.
- 16 LACKM H L von. The lumbosacral region. An anatomic study and some clinical observations. *J Am M Ass* 1924 82 1107-1114.
- 17 MIDDLETON, G S and TEACHER, J H. Injury of the spinal cord due to rupture of an intervertebral disc during muscular effort. *Glasgow M J*, 1911 46 139.
- 18 MITCHELL, G A G. The lumbosacral junction. *J Bone & Joint Surg* 1934 16 233-254.
- 19 Idem. Lumbosacral strain. *Lancet* 1936 1 75-80.
- 20 Idem. The significance of lumbosacral transitional vertebrae. *Brit J Surg* 1936 24 147-153.
- 21 MIXTER W J and AYER J B. Herniation or rupture of the intervertebral disc into the spinal canal. *New England J Med* 1931, 213 385-393.
- 22 MIXTER W J and BARR, J S. Rupture of the intervertebral disc with involvement of the spinal canal. *New England J Med* 1934, 211 210-214.
- 23 NELGEBAUER F. Spondylolisthesis et Spondylizeme. *Paris G Steinhilf*, 1892.
- 24 OBER F R. Back strain and sciatica. *J Am M Ass* 1933, 104 1380-1382.
- 25 Idem. Role of ilio-tibial band and fasciata as factor in causation of low back disabilities and sciatica. *J Bone & Joint Surg*, 1936 18 103-110.
- 26 PERRIER J G. Étude radio-clinique du carrefour lumbosacro-liaque. Theses de la Faculté de Méd. de Paris 1929, 36.
- 27 PITKEN H C and PHEASANT, H C. Sacroarthrogenetic talgia: study of referred pain. *J Bone & Joint Surg* 1936 18 111-133.
- 28 SCHMORL G and JUNGHAANS H. Archiv und Atlas der normalen und pathologischen Anatomie in typischen Röntgenbildern. Leipzig: Georg Thieme 1932.
- 29 SICARD HAGUENAU and WALLICH. Spondylolisthesis et atelle osseuse retro-spondylolithes. Syndrome de l'érection des apophyses épineuses lombaires. *Rev de neur.* 1924 March 23.
- 30 SMITH A. De F. Pain in the low back caused by structural variations in the spine. *New Jersey M Soc J* 1929 26 523-527.
- 31 Idem. Posterior displacement of fifth lumbar vertebra. *J Bone & Joint Surg* 1914, 16 87-888.
- 32 WILLIAMS P C, and YGLESIAS L. Lumbosacral facetectomy for postfusion persistent sciatica. *J Bone & Joint Surg* 1933 15 579.
- 33 WILLIS T A. The lumbosacral vertebral column in man: its stability of form and function. *Am J Anat* 1923 32 95-123.
- 34 Idem. Vertebral anomalies. *Am J Surg* 1929 6 163-168.
- 35 Idem. Separate neural arch. *J Bone & Joint Surg*, 1931 13 707-721.
- 36 Idem. Backward displacement of fifth lumbar vertebra. optical illusion. *J Bone & Joint Surg* 1935 17 347-352.

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF NEBRASKA COLLEGE

TECHNIQUE OF IMMEDIATE CHOLANGIOGRAPHY

R. RUSSELL BEST, M D, F A C S, and N. FREDERICK HICKEN, M D, Omaha, Nebraska

DURING the past 2 years, our experiences with cholangiography have led to certain improvements and refinements which we believe have greatly simplified the technique. As in the development of any technical procedure, these improvements have been brought about by trial and error, and we are fully aware that the investigations of others will also add valuable information. It has been found, too, that all contrast mediums can be utilized, but some because of their greater fluidity are easier to inject, while the heavier oily solutions seem to possess definite therapeutic properties. Since it is not the purpose of this paper to discuss the many values of cholangiography, it will suffice to say that time and experience have proved this method of visualizing the biliary tract increasingly practicable as a diagnostic aid. It has not only enlightened us about common duct pathology, but it has given us a clearer understanding of some of the failures following cholecystectomy, and has enabled us to relieve certain patients of an upper abdominal syndrome which would have relegated them to that group not benefited by gall-bladder surgery. It was observing delayed cholangiograms that prompted us to introduce the use of nitroglycerin tablets in relieving spasm of the sphincter of Oddi at the last meeting of the American Medical Association.

Immediate cholangiography is not a difficult or complicated procedure. It can be carried out in any hospital where there is a mobile or bedside x-ray unit, and once an immediate cholangiogram has been taken, the mere assembling of physical equipment becomes quite simple. The necessary articles are enumerated as follows: a bedside x-ray unit, a 14 by 17 double screen cassette, and a wooden tunnel such as is found in most x-ray departments and which is sufficiently large to admit the cassette. On the instrument table, in addition to the usual gall bladder set up, there should be a large sterile sheet, 25 cubic centimeters of 48 per cent hippuran solution, a 10 cubic centimeter syringe with a 23 gauge needle, and a 20 cubic centimeter Luer-Lok syringe with a 1 1/4 inch, 22-

gauge, short beveled needle (preferably, though not necessarily, the special needle with a metal bead 1/8 inch from the point). These articles should be assembled in the operating room before the anesthesia is started, so they will be immediately available.

The wooden tunnel containing the cassette and the film is placed beneath the patient. We have built padded inclines at either end of the tunnel, for the patient's comfort (Fig. 1). The tunnel expedites the removal of the cassette and the introduction of another, should a second exposure be desired. We have taken many cholangiograms at the table, however, by merely placing the cassette in the correct position under the patient before starting the anesthesia.

After the routine incision and exploration, the common duct is carefully palpated and, if no stones can be felt, it is immediately exposed. Isolation of the duct is more easily accomplished by incising the hepatoduodenal ligament near the junction of the cystic and common ducts and separating the margins of the peritoneum. Using the 23-gauge needle on the 10 cubic centimeter syringe, the exposed structure is definitely established as the common duct by withdrawing bile into the syringe. Since the amount of bile within the duct determines the dilution of the contrast medium, the plunger is drawn back as long as bile can be aspirated. The common duct is then gently grasped with two Allis forceps, one on either side of the small puncture wound made by the exploratory needle, and the field is ready for injection of the contrast medium.

A 22-gauge, short beveled needle, 1 1/4 inches long, has been found most practical for injection purposes. During the last few months, we have been using a needle which has a small bead 1/8 inch from the point (Fig. 2). The bead lends security in locating the end of the needle so it does not pierce the posterior wall of the common duct.

Experience has proved that the iodized oils which were first used as contrast mediums are difficult to introduce through small needles be-

LIPIODOL VISUALIZATION OF THE BILE TRACTS IN LESIONS WITH JAUNDICE

HILLIER L. BAKER, M D, AND CHARLES M. BACON, M D, Chicago, Illinois

VISUALIZATION of the biliary tract is a very helpful procedure in determining the patency of the bile ducts. Visualization may be done at operation or any time later if drainage is instituted. By this means, obstructive lesions which are overlooked or unsuspected may be discovered, such as stone, stricture, or pressure on the ducts by tumor, or the duct may be shown to be unobstructed, thus lessening operative interference. In a group of cases in which jaundice was present in varying degrees, we have employed visualization.

The interpretation of our findings were at times at variance with our clinical impressions. This is not difficult to explain, however, for as one reviews the literature on this subject, he is impressed with the wide variance of interpretations.

Visualization has shown the effect of drugs on the sphincter of Oddi. Spasm of the sphincter of Oddi has been demonstrated. Many of the older concepts as to the influence of the sphincter mechanism have been made clear. This will probably result in change in treatment, both medical and surgical, in gall tract disease.

The cases we wish to report are those in which jaundice was due to chronic pancreatitis, carcinoma of the head of the pancreas, and stricture of the common duct, in which the findings were suspected at operation and verified both by visualization or reoperation. Other cases included perforation of the gall bladder in which drainage had been done and those in which common duct stones were removed with T tube drainage. Visualization was carried out before the drain tube was removed so that chronic pancreatitis or other pathology would not be overlooked.

Lipiodol warmed in a water bath to 99 to 100 degrees F. in amounts varying from 10 to 20 cubic centimeters, was injected into the drain tube just above the skin margin of the wound, the tube being clamped above the site of injection so that the lipiodol solution would not be wasted. In cholecystostomy a Pezzer catheter was used and invaginated by pursestring sutures. This makes a nearly leak proof drain. Twenty cubic centimeters of lipiodol, when injected with a Luer syringe with slow ordinary pressure, fills the

bile ducts. When the common duct is injected through a T tube, 10 to 12 cubic centimeters suffices, unless there is a marked dilatation of the ducts, in which case more lipiodol will be required. Too rapid injection of the contrast material may cause pain or may cause a condition resembling shock, as is described later.

The following are histories of patients in whom visualization has been done.

CASE 1. Male aged 40 years entered the Presbyterian Hospital February 25 1935. For 5 years he had been treated for duodenal ulcer. That evening the patient was nauseated, vomited a small amount of clear fluid and had a severe pain in the abdomen which doubled him up. Temperature has 98.4 degrees pulse 80 white blood cells 15,000. The abdomen on physical examination had a hard boardlike feeling especially marked in the right upper quadrant. Physical examination was otherwise negative. A quarter grain of morphine was given. The abdomen remaining rigid and tender. A diagnosis of ruptured peptic ulcer was made and the patient was operated upon February 25 1935.

Operation. When the abdomen was opened there was a gush of clear colored fluid. The gall bladder was tense and a stone could be palpated in the cystic duct. There was a great deal of swelling about the gastrophrenic omentum and a blood tinged fluid was seen when the finger was introduced into the foramen of Winslow. Two small stones were removed from the gall bladder. An impacted stone in the cystic duct was removed by an incision of the duct and the duct was sutured. No stones could be palpated in common or hepatic ducts. Because of the acute pancreatitis the gall bladder was drained. Culture of the gall bladder bile showed no growth. Following operation the patient complained of severe upper abdominal pain at intervals which necessitated an opiate. There was no bile drainage until the sixth postoperative day when 650 cubic centimeters was collected. Following this the patient became more comfortable and he was discharged from the hospital 12 days after admission.

The patient was instructed to clamp the drainage tube two or three times daily so that obstruction of the duct could be ruled out. He said that after the tube was closed for 2 or 3 hours especially following meals he had a sensation of fullness in the upper right quadrant and in the back which compelled him to open the tube and when the bile flowed from the tube he felt relieved. This sensation gradually disappeared and on March 22 1935 the patient said he had the tube clamped for 7 days. There was no discomfort and his stools and urine were normal. No icterus of the skin or conjunctiva could be noted. Because of his postoperative discomfort 10 cubic centimeters of lipiodol was injected into the drainage tube of the gall bladder. In Figure 1 lipiodol is seen to fill the hepatic cystic and common ducts and the gall bladder. Figure 2 was made one half hour after a fat meal and shows a small amount of lipiodol in the small bowel though the gall ducts are still



Fig 1 Lipiodol fills the gall bladder, cystic, hepatic, and common duct, filling defect in the pancreatic portion of duct



Fig 2 Thirty minutes after fat meal Lipiodol is seen in the duodenum

filled Figure 3 was taken 1 hour after 1/100 grain atropine sulphate was given hypodermically. Here the bile ducts are fairly well emptied. The tube was removed from the gall bladder, as it was thought the ducts were patent.

The patient returned to the hospital 1 month later, April 23 1935. He complained of severe right upper quadrant pain which was referred to the back and shoulder blade and which was relieved by morphia.

The skin and sclera were deeply jaundiced. Itching was intolerable. The urine was dark with bile and repeated stool examinations failed to reveal any bile. Wassermann and Kahn tests were negative. White blood cells numbered 8,800, hemoglobin was 70, red blood cells 4,300,000. Temperature was 98.6 degrees, pulse, 88. Bleeding time was 5 1/4 minutes, coagulation time, 40 seconds.

After 4 days' observation, exploration was advised. A tentative diagnosis of common duct stone having been made.

On exposure of the bile ducts, no obstruction could be palpated. The head of the pancreas was uniformly thickened. The common duct was opened and explored, and a catheter passed into the duct as felt in the duodenum. It was thought a small stone could be felt in the ampulla, but that the stone had passed into the bowel. A T tube was placed in the duct and sutured in place, and the abdomen was then closed.

The postoperative course was uneventful. Bile drainage from the tube averaged about 500 cubic centimeters daily. The stool gradually became normal. The jaundice receded. The patient left the hospital 25 days later. Cultures of bile showed the *Bacillus coli*.

The T tube was allowed to remain in place, and for 2 weeks before lipiodol visualization of the tracts, the tube



Fig 3 One hour after 1/100 atropine sulphate was injected hypodermically ducts are nearly free of lipiodol



Fig. 4. Lipiodol injected into T tube passes at once into the duodenum



Fig. 5. One hour after fat meal bile tract is nearly entirely free of Lipiodol

was clamped off. No external drainage of bile occurred. The sensation of fullness which the patient complained of at previous operation gradually disappeared.

Fig. 4 and 5. Six cubic centimeters of lipiodol was injected through the T tube into the bile tract. A film taken immediately (Fig. 4) shows the lipiodol in the duodenum 1 hour later after a fat meal (Fig. 5) the tracts are entirely free of lipiodol. The thin tracture like shadow of the duct in the region of the head of the pancreas had disappeared. The T tube was allowed to remain in place for 2 more weeks. The icterus index was 25. The tube was removed. The patient has remained in good health since the removal of the tube.

From a study of the lipiodol visualization, the finding of acute inflammatory changes in the pancreas and subsequent history it seems that the resulting complications developing in this case are due to a pancreatitis with pressure on the bile ducts with resultant jaundice. The pain accompanying the closure of the drainage tube was due undoubtedly to back pressure of bile.

The next case so illustrates. This patient had the type of silent jaundice in which doubt arises as to whether we are dealing with a non obstructive or obstructive jaundice.

CASE 2. Mrs. E. C., 44 years of age a patient of Dr. C. M. Bacon entered the Presbyterian Hospital May 12, 1935. In March, the patient had an attack of indigestion and a few days later she had a pain in the epigastrium that doubled her up. The pain persisted for 4 hours, but did not radiate. She felt nauseated, but did not vomit. The dis-

tress passed off and from time to time she had had "various uneasiness" after eating especially fatty food.

Since April, 1935, she noted that her skin itched and had become yellowish in color and that her stools were clay colored and her urine very dark.

Examination showed white blood cells 6,400, red blood cells 4,800,000, hemoglobin 70 per cent, urine bile, 111, stools, no bile, Wassermann negative, Graham Cole, very poor filling of gall bladder. Fluoroscopy of stomach and colon was negative.

The patient was placed on medical management. She re-entered the hospital May 31, 1935. Laboratory findings: Bleeding time, 15 minutes, coagulation, 3½ minutes, white blood cells, 6,500, red blood cells, 4,700,000, hemoglobin 68 per cent.

The patient suffered with intolerable itching. On physical examination, the abdomen revealed a sharp liver margin extending about 3 inches below the costal border. No undue tenderness or rigidity was present. The skin and sclera were icteric and the physical examination was otherwise negative.

The patient was prepared for operation with a high carbohydrate diet. A direct blood transfusion was given immediately following operation. There was marked comfort when the abdominal incision was made, every bleeding point was ligated and the abdomen opened. The liver was enlarged, smooth, copper green in color. The gall bladder was dilated and contained about 1 to 2 cubic centimeters of thin greenish bile. No stones were palpated in the gall bladder or ducts. The head of the pancreas was firm, hard, though not of a cartilaginous hardness characteristic of carcinoma. There were many small dot like glands along the gastrophrenic ligament. The common duct was opened, the ducts were explored, and no stones were found. Because of the deep jaundice and high bleeding time, a T tube

was sutured into place in the common duct and the abdomen was closed. The operative diagnosis was chronic pancreatitis with a possibility of early carcinoma of the head of the pancreas.

There were no serious postoperative complications. The bile drainage was dark, thick, and averaged 355 cubic centimeters for 4 days. On the fifth day, 1,000 cubic centimeters of golden bile was collected. The average bile drainage for the next 38 days was 1,226 cubic centimeters daily.

By pushing fluids, the daily intake exceeded or equaled the combined biliary drainage and urinary output. The pigmentation of the skin and sclera was most persistent. The stools on repeated tests showed no bile. Duodenal tube drainage failed to reveal any bile in the duodenal contents. The urine became free of bile on June 11, 1935.

Lipiodol visualization of the ducts was carried out. Figure 6 shows the hepatic and common as well as the left pancreatic duct filled with lipiodol. There is no evidence of lipiodol in the intestinal tract. During this examination 20 cubic centimeters of lipiodol was used with moderate pressure. The patient complained of severe pain in the upper region of the liver and the back of the right side. This persisted until the drain tube was opened when the pain gradually decreased as the bile drainage increased. The pulse was slow and weak and the patient became cold, clammy, and perspired.

On July 11, 1935, revisualization of the ducts showed complete blocking and July 13, 1935, a cholecystostomy was done. A further exploration of the ducts failed to reveal any stones. The pancreas at this time was distinctly indurated, but the lobules could be distinguished on palpation. Following operation the stools became normal and the patient was discharged from the hospital on the twelfth postoperative day. She gradually regained strength and remained in very good health for about 6 months when pain in the right upper quadrant with nausea and vomiting became persistent and severe. X-ray studies showed a filling defect in the second portion of the duodenum with only partial emptying of the stomach. At exploratory operation, the head of the pancreas was found to be enlarged with a cartilaginous hardness. It practically obstructed the lumen of the duodenum. A posterior gastroenterostomy gave the patient a brief respite from her symptoms. She died 18 months after the onset of symptoms with the usual cachectic picture one sees in carcinoma of the head of the pancreas.

The following case, in which patient was a male aged 61 years, illustrates the value of exploratory operation and bile tract visualization in elderly patients with jaundice.

CASE 3. Male aged 61 years, entered the Presbyterian Hospital October 6, 1935 with the following history. During the past 6 weeks, the patient had developed a deepening painless jaundice with acholic stools and intolerable itching. There had been some nausea and loss of appetite, but a very slight loss of weight. The patient admitted leuc infection 20 years previously for which he had had prolonged treatment. He was also a moderate drinker. There had been no recent ingestion of toxic drugs or alcoholic excesses.

The essential findings on physical examination were those of a marked jaundice in an elderly, well-nourished male of 61 years. There was slight tenderness in the epigastrium. The liver was enlarged, the edges smooth and extended about 4 inches beneath the costal border. There was no evidence of ascites or edema. Temperature was 98.6 degrees, pulse 70, red blood cells 4,450,000, white



Fig. 6 Lipiodol injection shows complete obstruction at the ampulla of Vater with filling of the left pancreatic duct.

blood cells 12,350. Urinalysis showed bile, plus four. The icteric index was 151.8. Stools, on repeated examination, showed no bile. The Wassermann reaction was negative. X-ray studies of gastro-intestinal tract showed no demonstrable pathology. Rose Bengal test for liver function gave 37 per cent in 8 minutes and 57 per cent in 16 minutes.

Repeated duodenal intubation with injection of magnesium sulphate, 50 per cent solution, or olive oil, failed to cause biliary discharge. The patient was observed for about 2 weeks when an exploratory operation was advised. The diagnosis was probable impacted stone in the common duct or malignancy.

At operation, the liver was found to be enlarged and mahogany brown in color. The gall bladder was enlarged and distended. No stones were present in the gall bladder or ducts. The head of the pancreas was indurated. Thick, inspissated bile was aspirated from the gall bladder and a No. 28 Pezzer catheter was invaginated with two purse-string sutures. Five hundred cubic centimeters of blood was given by direct transfusion.

The postoperative course was uneventful, the daily average biliary drainage being 345 cubic centimeters. On the seventh postoperative day, bile appeared in the stools. Before patient left the hospital, the bile tract was visualized, 20 cubic centimeters of diodrast being used. A roentgenogram (Fig. 7) showed that most of the contrast fluid passed at once into the small bowel although some was in the ducts. A second film 1 hour later showed only a small amount in the inner tip of the drain tube.

The patient was instructed to clamp the drain tube for 1 hour daily, increasing the time period an hour each day if no discomfort was experienced. When he returned



Fig 7 Diodrast fills the ducts and passes at once into the duodenum

December 27 1935 the tube had been unopened for several days (Figs. 8 and 9) Lipiodol visualization was then done. The roentgenograms show the filling and emptying with lipiodol.

It is interesting to compare these films. Because of its viscosity, lipiodol is slower in emptying from the ducts whereas diodrast empties into the small bowel at once. This fact may account

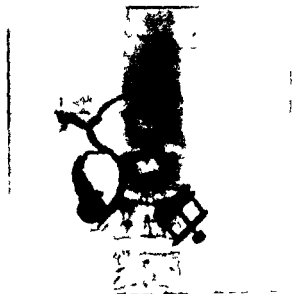


Fig 8 Lipiodol fills the bile tract but because of its viscosity does not at once enter the duodenum.

for the difference in interpretation in visualization of the bile tract and should be considered when contrast media such as diodrast are used. One month after the last visualization, the drain tube was removed. The patient has remained in good health since. The finding of a chronic pancreatitis with obstruction of the common duct was noted at operation. Spasm of the sphincter of Oddi is unlikely, for repeated duodenal lavage by drugs supposed to relax a sphincter spasm failed to bring the relief that decompression of the biliary tract by drainage effected.

CASE 4. Woman, aged 45 years entered the Presbyterian Hospital July 30 1935 with the following history. She had had a cholecystectomy in March, 1909 at which time a diagnosis of cholelithiasis was made. A few days following operation she complained of severe pain in the epigastrium and the right upper quadrant, which was referred to the back. She left the hospital in 15 days. Since the operation the patient has had recurring pain at intervals accompanied by nausea sometimes by vomiting with occasionally dark urine and jaundice. She has never noticed whether her stools were clay colored. She has lost 20 pounds in 2 years.

Physical examination was essentially negative. There were noted the old operative scar and tenderness in the right upper quadrant. The liver and spleen were not palpable. Temperature was 98.8 degrees pulse 96 respiration 20 blood pressure 126/72 hemoglobin 64 per cent red blood cells, 3,730,000 white blood cells, 63,000. Aetern index was 25.4 bleeding time 2 minutes coagulation 3 minutes. Wassermann reaction was negative. Van den Bergh very much delayed by the direct method.

An exploratory operation was done August 5 1935 by Dr W. Potts ethylene anesthesia being used. The ducts



Fig 9 One hour after fat meal tract is nearly free of lipiodol.

were found slightly enlarged. No stones were found, and a T tube was inserted into the common duct. Operative diagnosis: stricture of the terminal portion of the common duct. The postoperative course was uneventful. There was a flow of golden yellow bile that averaged about 650 cubic centimeters daily. The T tube was clamped daily for increasingly long periods, first for a 30 minute period and increasing until a 5 hour period was reached. On clamping the tube, the patient complained of pain in the right upper quadrant and back. The pain was so intense that she insisted the tube be opened. The stools have remained acholic but the urine was bile free. On August 15, 1935, a lipidol injection into the bile tract was done (Figs. 10 and 11). In the roentgenogram lipidol outlines the hepatic and common ducts. There is some lipidol in the small bowel. A film taken 1 hour later shows practically all the lipidol in the bowel. There is a small amount of lipidol in the hepatic ducts. The pancreatic portion of the common duct appears constricted. Lipidol injections were repeated on September 14, 1935, and revealed a similar defect in the pancreatic portion of the duct. One hour after a fat meal the x ray film showed only traces of the lipidol remaining in the ducts.

Despite the fact that the lipidol emptied from the ducts after a fat meal, closure of the drain tube for a 5 hour period caused the typical distress for which the patient entered the hospital. She was again operated upon and a choledochoduodenostomy was done. The patient left the hospital, and when last seen was entirely symptom free.

CASE 5. Male, aged 42 years, entered the Cook County Hospital in March, 1935, with a diagnosis of catarrhal jaundice. He gave the history of loss of weight, clay colored stools, and loss of appetite and strength. He noticed that his skin was yellow tinged and he complained of severe itching.

Physical examination was essentially negative, except for right upper quadrant tenderness and the presence of jaundice. He remained in the hospital for a short time, and when he left the jaundice had disappeared, and he felt perfectly well.

On August 24, 1935, he returned to the hospital complaining of severe oppressive pain in the epigastrium and lower chest which encircled the body. It was so severe that morphine did not give relief, and because a coronary thrombosis was suspected, he was given nitroglycerin 1/100 grain hypodermically which treatment gave him instant relief.

Physical examination revealed jaundice of the sclera and skin, slight tenderness in the right upper quadrant of the abdomen. The other findings were essentially negative. Temperature was 98 degrees, pulse 86. Examination showed that the stools and stomach content were normal. Wassermann reaction was negative, Graham Cole showed no filling. Icteric index was 37. Patient was prepared for operation. Eight hundred cubic centimeters of 25 per cent dextrose solution was given for several days, and he was transferred to surgery.

At operation September 2, 1935, the gall bladder was found contracted. No stones could be felt in the gall bladder, hepatic, or common ducts. The head of the pancreas was firm, hard and indurated. No nodules could be felt. The ducts were explored and a T tube was sutured in the common duct.

The postoperative course was uneventful. He was given dextrose solution 10 to 25 per cent intravenously for 3 or 4 days. The T tube was clamped after the third day. The average drainage through the T tube was 200 cubic centimeters daily.

On September 24, 1935, lipidol injection of the gall tract showed that common and hepatic ducts were outlined with a slight amount of lipidol in the first portion of the duodenum. One hour after a fatty meal the ducts were entirely free of lipidol. The T tube was removed some weeks later.



Fig 10 Lipidol injection shows a structure of the pancreatic portion of the common duct



Fig 11 One hour after fat meal lipidol has passed into the small bowel



Fig 12 Lipiodol fills the bile tracts and passes into the duodenum

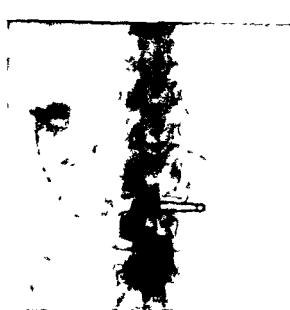


Fig 13 Bile tracts free of lipiodol after fat meal. No obstruction in duct.

The probable diagnosis in this case was common duct stone which may have been passed when the patient was admitted the second time to the hospital, at which time he suffered such severe pain. That there was an associated pancreatitis was evidenced at operation. The lipiodol injection does not show that the induration is now present and the T tube was removed some weeks later.

CASE 6 Female, aged 67 years was admitted to the hospital with a history of recurring attacks of pain and discomfort in the right upper quadrant of 30 years' duration. This last attack had been more severe than any preceding one, being accompanied by chills, fever, nausea and vomiting as well as by severe pain. She stated that she had been jaundiced at times, but the jaundice had always subsided. This time however the jaundice had persisted.

The patient was a well nourished female of apparent age with slight icteric tinge to the sclera. She appeared acutely ill.

The physical findings were essentially normal with the following exceptions. There was marked rigidity and tenderness in the region of the gall bladder, and a slight abdominal distention. Temperature was 100.6 degrees, pulse 90, white blood cells 21,000. Urine was negative on analysis. The patient had been acutely ill for several days before admission. She was treated conservatively for a few days, there being no subsidence of symptoms and on leucocytic increase operation was advised with the diagnosis of acute cholecystitis with stone. At operation a small perforation at the fundus of the gall bladder was found. The gall bladder contained many stones. An impacted stone was dislodged from the cystic duct. No stones could be felt in the hepatic or common duct or ampulla of Vater. The right hepatic, cystic and common ducts were thick and indurated. The head of the pancreas

felt normal. A No. 20 Pezzer catheter was invaginated into the gall bladder for drainage. The patient made an uneventful recovery.

The tract was later visualized so that residual tones might not be overlooked (Figs 12 and 13). Bile was allowed to drain for several weeks following operation so that the infection in the ducts could be relieved. The tube was then clamped at intervals as described and removed 3 months after operation. The patient has continued in good health since operation.

CONCLUSIONS

1 Visualization of the bile tracts at operation may be decidedly helpful in the finding of unsuspected causes of obstruction such as stricture, stone, and extraductal or intraductal pressure. It may reduce operative time by showing that no obstruction is present.

2 Visualization in cases of drainage may be helpful in showing that the bile tract is unobstructed, or that induration of the biliary tract is still present and that continued drainage is advisable.

3 Visualization using varying types of contrast media may be helpful in a study of the sphincter mechanism of the biliary tract.

4 Early decision that the lesion is an operative one is essential so that patients who, because of their age and condition, may be given the benefit of prompt surgery. This is important because of the difficulty in distinguishing between malignant and non malignant obstruction.

5 Active measures to combat the effect of

jaundice are those that seek to repair the damage to the liver, the blood, and other organs. The giving of glucose intravenously or by mouth, the use of calcium salts such as calcium gluconate, and finally repeated blood transfusions, are important.

6 Relief of the jaundice with minimum trauma to the patient is essential. Cholecystotomy or common duct drainage with removal of the offending cause at a subsequent period may be a factor in reducing operative mortality. If the patient's condition permits, direct visualization of the bile tracts may make a second operation unnecessary.

7 Postoperative maintenance of fluid balance and blood chlorides is essential to compensate for the loss by external biliary drainage.

8 Control of biliary drainage by the use of a soft, pliable T-tube or a Pezzer catheter prevents too rapid hepatic decompression, and also is a factor in preventing fluid loss.

BIBLIOGRAPHY

- 1 HILKEN, N F, BEST, R R, and HUNT, H B. Cholangiography: visualization of the gall bladder and bile ducts during and after operation. *Ann Surg*, 1936, 103: 210-229.
- 2 ILY, A C. Physiology of the gall bladder. *Physiol Rev*, 1934, 14: 1-102.
- 3 MELTZER, S J. Diseases of the bile ducts and gall bladder. *Am J M Sc*, 1917, 153: 469.
- 4 MIRIZZI, P L. Cholangiografía durante las operaciones de las vías biliares. *Bol y trab Soc de cirug de Buenos Aires*, 1932, 16: 1133-1161.
- 5 NEWMAN, C. Physiology of gall bladder and its functional abnormalities. *Lancet*, 1933, 1: 785-841, 896.
- 6 RAVDIN, I S, JOHNSTON, C G, RIEGEL, C, and WRIGHT, S L, Jr. *Am J Physiol*, 1932, 100: 317.
- 7 THORLAKSON, P H I, and McMILLAN, J C. Common duct obstruction: lipiodol studies of cholangiectasia showing effects of prolonged drainage. *Canadian M Ass J*, 1934, 31: 269.
- 8 WHITTAKER, R. The mechanism of the gall bladder. *Am J Physiol*, 1926, 78: 411. Experiences with cholecystography including observations on functions of gall bladder. *J Am M Ass*, 1926, 86: 239-243.

ADDITIONAL ADVANTAGES OF THE HAWLEY TABLE

GEORGE W. HAWLEY, M.D., F.A.C.S., Bridgeport, Connecticut

FRACTURES of the spine have been on the increase during the past few years. Automobile accidents chiefly account for this increase. Forced flexion of the spine results in compression fracture. This may be the sole injury.

Improvement in roentgenographic technique, especially the perfection of lateral graphs, has From the Orthopedic and Fracture Service of the Bridgeport Hospital

made it possible to detect these fractures with greater accuracy and certainty. The element of error has been reduced and fewer fractures are overlooked.

The introduction of hyperextension in the treatment of these fractures has been a step forward. This method usually results in reduction of the fracture deformity, even when there is an associated dislocation.

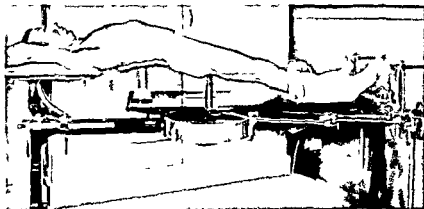


Fig 1



Fig 2

Fig 1 above Hyperextension of spine by direct application of force. An automobile jack is used to exert pressure at the point of fracture. This is a direct method of hyperextension in contrast to indirect, physiological, or postural hyperextension.

Fig 2 Hyperextension of spine by posture. Ventral position with legs suspended and thighs extended on pelvis. Head can be raised by elevating foot pieces at end of leg bars. Patient exposed for roentgenography and application of plaster.

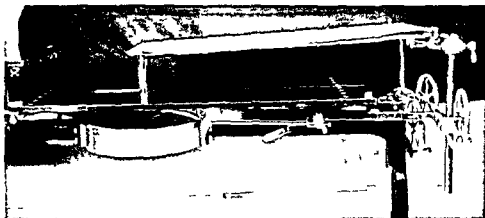


Fig 3

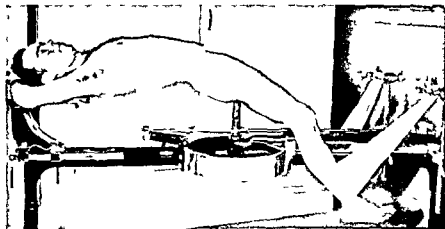


Fig 4



Fig 5

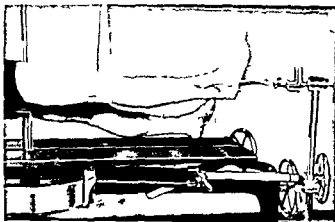


Fig 6

Fig 3 Hammock for ventral suspension Several layers of a 5 inch muslin bandage are wound between the central cross bar and the bar resting on foot pieces. The hammock is made taut by extending leg bars. After hammock is in place the table top is raised the patient is placed on the table and is suspended as in Figure 2

Fig 4 Physiological hyperextension of lumbodorsal spine (Site of many compression fractures) Dorsal position. The lower section of the table top is removed. The thighs and legs are then extended. In the dorsal position it is possible to examine, roentgenograph hyperextend, and immobilize without moving patient. Increased hyperextension is secured by using the sling as shown in Figure 5

Fig 5 Hyperextension by sling Several thicknesses (to give strength and prevent wrinkling) of muslin bandage are used with a pad of felt. The sling can be used in combination with extension of the legs as shown in Figure 4

Fig 6 Traction on tibia using Kirschner wire or Steinmann pin through the lower end of the tibia or os calcis. Wire is introduced and a loop is applied with the table top raised and the leg resting on the table. The method is effective in the reduction of fresh fractures and immobilization in plaster. Roentgenologic control is convenient. The method is useful in open reductions to obtain traction during operation.

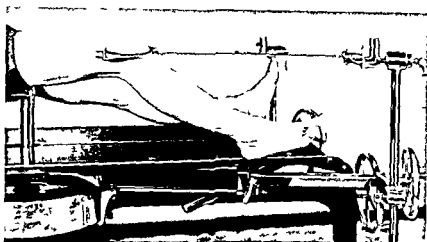


Fig 7

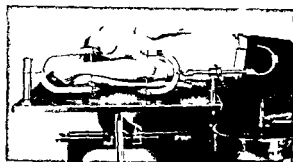


Fig 8



Fig 9



Fig 10

Fig 7 Skeletal traction on femur

Fig 8 Skeletal traction on forearm Two wires are

used, one for traction and one for countertraction. The distal wire is placed 1 inch from the end of the radius external to the radial vessels and other wire is placed $1\frac{1}{4}$ inches from the tip of the olecranon. Both wires are slightly off center and on different bones, but experience shows that the method is effective in the reduction of fractures of one or both bones.

Fig 9 Suspension of the forearm and elbow with manual traction. Patient is placed on the table. The elbow hook provides a firm point of countertraction. The arm is free for examination, manipulation, roentgenological examination by fluoroscope or graph. The method is effective in elbow fractures and dislocations, in fractures and dislocations of the head of the radius, in fractures of the radius and ulna, in Colles' fractures where it is possible to combine strong traction with manipulation and leverage at the point of fracture, and in dislocations of the semilunar.

Fig 10 Control and suspension of the forearm with patient sitting by the table. This method is useful in subjects suitable for reduction under local anesthesia.

Figures 1 to 5 depict the various ways of securing hyperextension on the fracture table.

SKELETAL TRACTION

Skeletal traction has become a standard method of fracture treatment. It is in general use, espe-

cially since the introduction of the Kirschner wire and tension loop. Figures 6 to 8 are three photographs showing skeletal traction as applied to the tibia, to the femur, and to the bones of the forearm. In the first two, the wires are introduced with the table top up and the perineal post used

for countertraction. The limb is exposed for physical examination, manipulation, and roentgenologic examination by fluoroscope or graph. After reduction, the table top is lowered for immobilization in plaster.

Figures 9 and 10 show suspension and manual traction in the treatment of fractures of the elbow and bones of the forearm. The elbow hook makes a point of strong countertraction. Experience has shown that strong traction is readily borne without the use of padding. This method is

practical and effective in the treatment of diaphyseal fractures of the humerus, dislocations of the elbow, dislocations and fractures of the head of the radius, fractures of shaft of radius and ulna, and Colles' fractures, where it is possible to combine strong traction with manipulation and leverage at the point of fracture. The arm is exposed for roentgenological examination before, during, and after the treatment, and is in position for plaster encasement after reduction has been effected.

THE "HANGING CAST" IN THE TREATMENT OF FRACTURES OF THE HUMERUS

A D LAFERTÉ, M D, I A C S, and M G ROSENBAUM, M D, Detroit, Michigan

THE "hanging cast" is a plaster cast applied from the axilla to wrist with the elbow flexed to a right angle, a sling suspends the cast from the neck. It was first suggested by Dr J A Caldwell in 1933, for some fractures of the shaft of the humerus. We have used the "hanging cast" extensively in fractures of the shaft and of the neck of the humerus. It is our purpose to report roentgenographic and clinical results obtained in 58 cases in which patients were treated at Receiving Hospital during the year beginning November 23, 1935, and ending November 23, 1936, and to discuss the advantages and disadvantages of this method.

The treatment of fractures of the humerus in adduction has been debated considerably. Various authors (2, 3, 4, 5, 6, 7) suggest different methods, but none offers case reports so that no comparison of results is permitted. We hope that our data will be of value in answering this question.

Not all fractures of the humerus were considered suitable for treatment with the "hanging cast", badly comminuted fractures of the head and fractures involving the condyles or the supracondylar area were treated by other methods.

The patients whose histories are reported in this paper were observed from the time of injury until discharged from the clinic with healed fractures. All cases in which patients were so ob-

served are reported so that poor as well as satisfactory results are presented. A number of cases in which progress was satisfactory are omitted from this report because the patients did not return for final examination.

We have used the following classification based upon the x ray findings in the fracture when first seen.

1 Fractures of the upper-third of the humerus (a) in good or fair position, (b) in poor position.

2 Fractures of the middle and lower thirds of the shaft of the humerus (a) in good or fair position, (b) in poor position.

Twenty three fractures were in the upper-third of the humerus in good or fair position. The cast was applied following x-ray examination with the patient either sitting or recumbent, the injured arm was abducted carefully and the elbow flexed, while plaster was applied extending from the axilla to the wrist, not including the wrist joint. Three rolls of plaster, 6 yards long by 6 inches wide were used for adults, the cast weighed about 2 pounds when dry. A plaster loop was incorporated at the wrist to permit suspension from the neck. The cast was trimmed at the axilla and wrist so that motion would cause no discomfort. Passive motion at the shoulder was then employed whereby the patient leaned forward and let the arm swing, later, active motion was urged. Active motion of the wrist was encouraged from the beginning. Following application of the cast, the position of the fragments was deter-

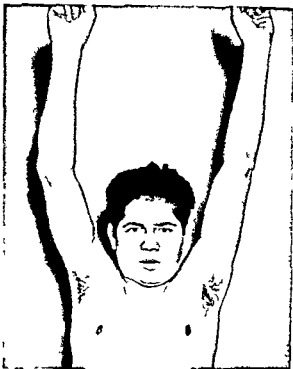


Fig. 1 Case 42 (Table III) One week after removal of hanging cast and 5 weeks after transverse fracture of middle third of humerus

mined by x ray examination. The progress of the patient was observed at 2 week intervals.

In this group the age varied from 5 to 86 years. Practically as many transverse as oblique fractures occurred. The cast was applied soon after the accident, although this was delayed when the general condition of the patient was poor (Cases 2 and 3). In 9 cases (7, 8, 13, 14, 18, 19, 21, 22, 23) the patient was not hospitalized. The cast was removed after periods varying from 3 to 9 weeks depending upon clinical and roentgenographic findings. It is interesting to note that there was no slipping of the fragments except in Cases 2, 9 and 10 where definite improvement in position occurred. We do not believe that this method should be used to correct a displacement, only fractures in good or fair position should be so treated. Displacement should be corrected by manipulation or operation.

While the consistently satisfactory roentgenographical results are important, yet the early and unusually good function of the shoulder is the outstanding feature of the method (Fig. 1). Upon removal of the cast or upon the discontinuance of physiotherapy, as shown in Table I, a shoulder which functioned almost as well as

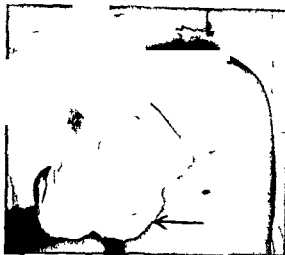


Fig. 2 Abduction wedge on inner side of cast to prevent lateral angulation

before injury was termed excellent. The ability to abduct the arm to 90 degrees, with only slight limitation of external rotation was considered 'good', a less degree of function was termed 'fair'. Slight motion was termed 'poor'. We have observed that a shoulder which was not permitted motion for a period of 6 or 8 weeks would have marked limitation of motion and muscular atrophy, function returned but partially with extended physiotherapy.

If in the use of the 'hanging cast' a patient is encountered who would not do the bending exercises as advised, it would seem to us that a cast which held the arm in abduction would be preferable as physiotherapy would probably restore motion at an earlier date. Treatment with the

hanging cast does not immobilize the fracture site; it does offer the patient the opportunity to restore the shoulder to as near normal function as possible. We emphasize this point, because some patients do not understand, or are afraid to follow directions. These patients must be seen at frequent intervals for examination and encouragement. In this group, 3 cases (9, 10 and 14) required extensive physiotherapy to the shoulder, the rest carried out exercises at home. Little difficulty was experienced because of immobilization of the elbow, residual stiffness disappeared with moderate use. Atrophy of muscle and bone from disuse was almost avoided.

The appearance of the shoulder in this series was normal. Union occurred without delay. No complications were observed.

Ten fractures were in the upper third of the humerus and were variously displaced. Two

TABLE I—FRACTURE OF THE UPPER THIRD OF THE HUMERUS INCLUDING THE SURGICAL NECK IN GOOD OR FAIR POSITION

Case	Age	Type of fracture	Date of injury	Cast applied	Number of weeks in cast	Final x ray	Physiotherapy	Function of shoulder
1 Mrs H B	57	Irregular transverse	11-3-35	11-25-35	8	Excellent	No	Excellent
2 Mr A L	76	Spiral oblique	12-2-35	12-6-35	5	Excellent	No	Excellent
3 Mr T W	55	Transverse	12-4-35	12-10-35	7	Excellent	No	Good
4 Mrs L R	46	Transverse	12-4-35	1-5-35	5	Excellent	For 2 Wks	Excellent
5 Mrs C M	86	Oblique	12-24-35	1-27-35	4	Excellent	No	Excellent
6 Mrs M M	59	Oblique	1-8-36	1-9-36	9	Excellent	No	Excellent
7 Mrs M M	72	Oblique	1-20-36	1-20-36	8	Excellent	No	Good
8 Mr L M	53	Spiral, oblique	1-30-36	1-30-36	4	Good	No	Excellent
9 Mrs M E	67	Irregular transverse	2-4-36	2-5-36	8	Excellent	For 3 mos	Good
10 Mrs I T	63	Oblique	2-4-36	2-5-36	4	Excellent	For 4 wks	Excellent
11 Mrs R S	38	Oblique in partial apposition	4-6-36	4-7-36	8	Good	No	Excellent
12 Mr P B	37	Oblique	4-20-36	4-21-36	7	Good	No	Good
13 Miss M C	12	Transverse	6-1-36	6-1-36	1	Excellent	No	Excellent
14 Mr O G	62	Transverse	6-8-36	6-8-36	6	Excellent	For 8 wks	Fair
15 Mrs L B	31	Transverse	6-10-36	6-12-36	7	Excellent	No	Excellent
16 Mr E P	44	Oblique comminuted	6-11-36	6-12-36	4	Excellent	No	Excellent
17 Miss E C	25	Transverse	6-15-36	6-16-36	5	Excellent	No	Excellent
18 Mr G C	21	Oblique	7-18-36	7-18-36	5	Excellent	No	Excellent
19 Miss D S	14	Transverse	8-27-36	8-27-36	4	Excellent	No	Excellent
20 Mr B H	65	Oblique	9-3-36	9-4-36	7	Excellent	No	Good
21 Mr S A	5	Oblique	9-10-36	9-10-36	4	Excellent	No	Excellent
22 Mr E D	65	Transverse	9-14-36	9-14-36	5	Excellent	No	Excellent
23 Mrs T A	74	Transverse	10-15-36	10-15-36	6	Excellent	For 3 wks	Good

children suffered displacement of the shaft laterally to the neck, 8 adults suffered displacement of the shaft medially with overriding of the fragments in all but 2 cases

Early manipulation under deep anesthesia was first attempted. With the patient recumbent on the fluoroscopic table, strong force was applied to the arm in two directions—first, by traction with a flannel band passing around the flexed elbow of the patient and around the operator's waist, and, second, by pressure exerted at the fracture site at right angles to the shaft, to correct the medial or lateral displacement. Countertraction was obtained by a sheet around the thorax. Spasm of the pectoral muscles was overcome with difficulty. Usually, a reduction of the displacement could often be seen externally. The "hanging cast" was applied when a good reduction was evident in the fluoroscope. Roentgenograms were taken the next day and at 2 week intervals. Satisfactory

reductions were obtained by manipulation in 5 cases

In 2 cases (24 and 29) in which manipulation failed, traction by means of a Kirsch wire through the olecranon was used. No final treatment was obtained. Open reduction was the final treatment.

It is our belief that open reduction, when manipulation fails. In one case (24) a plane spica was applied for 3 weeks, operation, and then replaced by a "cast." In 3 cases (28, 29, and 33) "cast" was applied following open reduction. Fixation of the fragments was used by interlocking of edges, yet the fragments retained their positions. Perhaps the conservative procedure when displacement is corrected by operation is to immobilize for a 3 week period, and then treat with the "hanging cast."

TABLE II—FRACTURE OF THE UPPER THIRD OF THE HUMERUS INCLUDING THE SURGICAL NECK IN POOR POSITION

Case	Age	Date of injury	Type of displacement	Corrective procedure	Number of weeks in cast	Final x ray	Physiotherapy	Function of shoulder
24 Mr S B	31	11-24-35	Shaft medial to head with 1/2 inches overriding	Manipulation and skeletal traction unsuccessful open reduction with airplane spica hanging cast applied after 3 weeks	5	Excellent	For 2 mos	Normal
25 Mr F J	49	12-23-35	Shaft medial to head with 1/2 inches overriding	Manipulation hanging cast	8	Excellent	For 3 mos	Fair
26 Mr P G	3	5-7-36	Shaft lateral to neck with 1 inch overriding	Manipulation unsuccessful, other correction refused hanging cast	3	Poor	No	Excellent
27 Mrs. E D	69	7-14-36	Shaft medial to neck with 1/2 inch overriding	Manipulation and hanging cast	6	Good	For 4 mos	Good
28 Miss A J	32	7-15-36	Oblique fracture with 1/2 inch overriding	Manipulation unsuccessful open reduction and hanging cast	4	Excellent	No	Excellent
29 Miss F C	7	7-22-36	Shaft lateral to neck with 1/2 inch overriding	Manipulation and skeletal traction unsuccessful open reduction and hanging cast	5	Excellent	No	Normal
30 Mr G K	65	8-6-36	Communion of neck with 1/2 inch overriding	Manipulation delayed 14 days hanging cast	6	Good	For 2 mo	Good
31 Mr F W	77	8-6-36	Shaft medial to head with 1 inch overriding	Manipulation hanging cast	7	Excellent	For 3 mos	Fair
32 Mr H L	35	8-10-36	Shaft medial to head with 1 inch overriding	Manipulation hanging cast	8	Excellent	For 2 wks	Good
33 Mr K P	27	8-29-36	Shaft displaced inward	Manipulation unsuccessful open reduction and hanging cast	6	Good	For 2 mos	Fair

Case 26 is of interest. The child had lateral displacement of the shaft with overriding of 1 inch. Manipulation under anesthesia failed. The parents refused permission for hospitalization or operation. A hanging cast was applied for 3 weeks, solid union occurred with no improvement in the position of the fragments. The shoulder function was normal, some deformity was evident. The roentgenographical result was unsatisfactory.

Union occurred in all without delay, the cast being removed after periods varying from 3 to 8 weeks. The appearance of the shoulders was normal. No vascular or neurological complications occurred. In Case 31 the patient suffered a contracture of the fingers despite satisfactory function in the wrist, elbow, and shoulder. More physiotherapy was required in these cases than in the undisplaced fractures (Table II).

A review of 33 fractures of the surgical neck of the humerus shows that good results, both anatomical and functional, can be obtained by the "hanging cast." Long periods of hospitalization in a recumbent position are avoided, airplane splints and spicas are avoided. The advantages to the aged are many. Manipulation offers better results than traction in the correction of displacements. To the co-operating patient the "hanging cast" presents an opportunity to

obtain a good functional result, the patient, however, must be closely supervised. Simplification of treatment of these fractures is not without its hazards. Most patients will not carry out active motion unless constantly encouraged. The fact that the fracture site is not immobilized presents an obvious target for criticism, but in the series here reported, no case suffered delayed union or non union.

Sixteen fractures involved the middle or lower third of the shaft and were in good alignment and partial or total apposition. Ten were transverse fractures of the middle third of the shaft. Three fractures were comminuted and irregular, 2 were through the thinned walls of bone cysts. All but 2 occurred in adults.

In this type of fracture, the chief problem was to maintain good apposition and alignment while applying the cast and during the convalescent period. When the cast was applied many of these fractures would slip out of position unless the elbow was maintained in acute flexion. If acute flexion made the application of the circular cast impossible, a posterior plaster splint was applied and the cast was then completed. Moderate traction at the elbow usually sufficed to hold the fragments during the application of the plaster. No anesthetic was used in these fractures. Fluoroscopic and roentgenographical examinations were

TABLE III—FRACTURES OF THE MIDDLE AND LOWER THIRD OF THE HUMERUS IN GOOD OR FAIR POSITION

Case	Age	Type of fracture	Date of injury	Cast applied	Number of weeks in cast	Final x ray	Physiotherapy	Function of elbow and shoulder	Cosmetic result
34 Miss E B	32	Oblique in lower third	11-30-35	12-2-35	9	Excellent	For 1 wk	Normal	Excellent
35 Mrs C M	38	Transverse middle third	12-1-35	12-2-35	8	Excellent	For 2 mos	Normal	Excellent
36 Mrs C E	28	Transverse middle third	12-18-35	12-20-35	8	Excellent	No	Normal	Excellent
37 Mr L M	52	Transverse middle third	12-19-35	12-21-35	8	Excellent	No	Normal	Excellent
38 Mr A S	32	Bullet fracture middle third	1-1-36	1-5-36	7	Slight lateral bowing	No	Excellent	Excellent
39 Mr J M	55	Transverse middle third	1-17-36	1-19-36	8	Slight lateral bowing	For 3 wks	Normal	Excellent
40 Mrs L K	40	Transverse middle third	2-19-36	2-20-36	8	Excellent	For 2 wks	Normal	Excellent
41 Mr O O	57	Lower third refracture of bone cyst	2-25-36	2-26-36	8	Anterior bowing	No	Normal	Good
42 Mr W M	18	Transverse middle third	4-30-36	4-31-36	4	Excellent	No	Normal	Excellent
43 Mr G H	45	Comminution with marked separation middle third	6-6-36	6-7-36	5	Poor	No	Normal	Good
44 Miss M B	25	Transverse middle third	8-6-36	8-7-36	5	Excellent	No	Normal	Excellent
45 Mr L I	16	Transverse middle third	8-7-36	8-8-36	4	Excellent	No	Normal	Excellent
46 Mr J K	62	Transverse middle third	8-10-36	8-11-36	6	Good	No	Normal	Good
47 Mrs M M	28	Lower third oblique comminuted	9-12-36	9-13-36	9	Slight lateral bowing	For 2 wks	Normal	Excellent
48 Mr A U	7	Oblique through a large cyst in middle third	9-18-36	9-19-36	3	Excellent	No	Normal	Excellent
49 Mr A M	35	Irregular transverse middle third	10-28-36	10-28-36	4	Excellent	For 3 wks	Good	Excellent

used to determine the position of the fragments in the cast

A number of patients who had had casts applied, especially those with acute flexion of the elbow, were observed daily during the first week for swelling and cyanosis of the hand. If these symptoms appeared, they were relieved by splitting the cast. Patients were then observed at 2 week intervals, and the position of the fragments was determined by x-ray examination. Casts were applied for periods varying from 3 to 9 weeks.

Anatomical results were satisfactory in all cases except one badly comminuted fracture (Case 43). Two types of deformity, lateral bowing and anterior bowing, occurred frequently. The former occurred more commonly in fractures of the middle third and a combination of the two in fractures of the lower third. Lateral bowing occurred when the proximal fragment was displaced laterally, usually because of a large breast or a barrel shaped chest. Lateral bowing was readily corrected by the application of a small wedge to the cast at the inner side of the elbow (Fig 2). Anterior bowing was incurred when the forearm

was permitted to drop, this was corrected by shortening the wrist neck sling. Even when the humerus was in excellent position in the cast, it was necessary to observe the patient at 1 or 2 week intervals because of a common tendency to remove or lengthen the wrist neck sling and thus permit anterior bowing. Even intelligent patients required watching. Early active motion was encouraged in the shoulder, wrist, and hand.

Functional results were excellent in all cases, a normal shoulder and elbow being obtained.

In any discussion of the results of treatment of a fracture of the shaft of the humerus, the cosmetic result must be considered as seriously as the anatomical or functional result. In heavily muscled arms, deformity due to excess callus, angulation, or poor apposition, may be well concealed. However, children and most adults usually have such thin biceps, brachialis and triceps muscles, that any asymmetry or prominence at the fracture site is easily seen. The appearance of an extremity is the first concern of the patient when the cast is removed, often it is the most important one. Perhaps no factor will cause the patient to seek the services of another doctor

TABLE IV—FRACTURES OF THE MIDDLE AND LOWER THIRD OF THE SHAFT OF THE HUMERUS IN POOR POSITION

Case	Age	Date of injury	Type of fracture	Corrective procedure	Number of weeks in cast	Final x ray	Physiotherapy	Function of elbow and shoulder	Cosmetic result
30 Mr T P	20	12-15-35	Transverse 1 inch overriding	Manipulation with local anesthetic hanging cast	8	Excellent	No	Normal	Normal
31 Mrs J M	38	2-15-36	Transverse 1 inch linear separation	Two manipulations under general anesthesia hanging cast	8	Lower fragment displaced anteriorly	No	Normal	Good
32 Mrs J D	37	2-25-36	Transverse 1 inch overriding	Manipulation without anesthesia hanging cast	8	Lower fragment anterior	No	Normal	Good
33 Mr H J	35	3-24-36	Transverse 1 inch overriding	Manipulation without anesthesia hanging cast	8	Good	No	Normal	Excellent
34 Mr A S	46	4-20-36	Oblique 1 inch overriding with lateral angulation	Manipulation without anesthesia hanging cast	5	Good	No	Normal	Excellent
35 Mrs M C	39	7-11-36	Oblique 1 inch lateral separation	Open reduction hanging cast	6	Anterior angulation excessive callus	For 1 mo	Excellent	Fair
36 Mrs B H	26	7-20-36	Spiral oblique with anterior angulation	Manipulation without anesthesia hanging cast	6	Excellent	For 1 mo	Normal	Excellent
37 Mr R M	25	8-18-36	Spiral oblique, in partial apposition	Manipulation without anesthesia hanging cast	4	Excellent	No	Normal	Excellent
38 Mr D C	13	8-18-36	Transverse with 1 inch overriding	Manipulation without anesthesia hanging cast	6	Slight lateral angulation	No	Normal	Fair

and perhaps of a lawyer as readily as a deformed extremity following a fracture. We have, therefore, included a description of the cosmetic result obtained in the cases herein reported. Two cases will be discussed to illustrate the importance of this factor. Normal appearance of the arm was obtained in 13 cases: slight bowing or excess callus gave a less satisfactory appearance in 3 cases (41, 43, and 46). A good cosmetic result despite a poor roentgenographical appearance was obtained in Case 43 because of heavy muscles; the patient was well pleased. A young lady with a transverse fracture of the mid shaft was observed for a 12 week period before much callus appeared. Becoming overconfident she dispensed with the wrist sling despite frequent and careful warnings. Obvious anterior bowing was incurred, our offer to correct the deformity under anesthesia resulted in the patient leaving the clinic. Had the simple instructions been followed, an excellent result would have been obtained. Frequent supervision is necessary for this type of patient.

One patient (Case 44) had a radial nerve paralysis, despite an excellent reduction of the fracture. No other complication was observed.

Union occurred in all, a surprisingly short time was required in most cases for good callus and

partial union. Physiotherapy was given a few patients for short periods (Table III).

Nine fractures involving the shaft were displaced, overriding, angulation, poor apposition, linear and lateral separation, occurred in this group. All but one fracture occurred in adults.

At first, manipulations were carried out under general or local anesthesia; our experience has been that fractures of the shaft can usually be manipulated with no anesthetic, if the patient has the least desire to co-operate. Indeed, in one patient (Case 35) a distraction of 1 inch was obtained by manipulation under anesthesia. Six fractures were manipulated without anesthesia. One open reduction was performed.

Manipulations were carried out with the patient on a fluoroscopic table. A flannel band passed through the flexed elbow and about the body of an assistant facilitated careful traction. Plaster was applied to the fracture site and to the forearm when the fluoroscopic examination showed a good reduction. Marked flexion of the elbow was necessary to maintain reduction in transverse fractures of the lower third of the shaft. Following x ray examination, the patient was observed at 2 week intervals. Casts were applied for periods varying from 5 to 8 weeks.

Anatomical results varied. One patient (Case 58) obtained a less satisfactory result because of her refusal to return for examinations. Cosmetic results were satisfactory.

Union occurred in all cases. Little physiotherapy was required. There were no complications in this group.

This warning may be repeated, lateral bowing and anterior bowing are two deformities most to be avoided (Table IV).

SUMMARY

1. The use of the "hanging cast" has been found efficient in the treatment of most fractures of the humerus.

2. A report is presented on the results of treatment by use of the "hanging cast" in 58 consecutive cases in 1 year, of fractures of the neck and shaft of the humerus.

3. Badly comminuted fractures of the head and fractures including the condyles or the supracondylar area are not considered suitable for this method of treatment.

4. The reduction of displaced fractures is accomplished before application of the cast.

5. An interpretation is given of the terms "excellent," "good," "fair," and "poor" used in this discussion. The fractures are grouped according to location.

6. No attempt is made to immobilize the fracture site, notwithstanding which there have been no cases of delayed or non union.

7. Twenty-three fractures of the upper third of the shaft and of the neck are described and the satisfactory results noted.

8. Twenty-five fractures of the lower two-thirds of the humerus were treated by the use of the "hanging cast" with satisfactory results.

9. The application of a plaster wedge to the inner side of the cast in certain individuals prevents lateral angulation.

10. In caring for a fractured humerus in a non-co-operating patient some other form of treatment is advised.

11. Early motion at the shoulder and wrist are insisted upon and results in nearly normal joint motion and muscle development upon removal of the cast.

12. Following removal of the cast, physiotherapy was used in but 20 of the 58 cases. This was found to be most consistently indicated in fractures occurring at or near the surgical neck of the humerus, in which there had been marked displacement of the fragments at the time of fracture.

13. The use of the "hanging cast" reduces hospitalization to a minimum.

BIBLIOGRAPHY

1. CALDWELL JOHN A. *Ann Surg.*, 1933, 97, 161.
2. FUNSTEN ROBERT V. and KINSER, PRENTICE J. *Bone & Joint Surg.*, 1936, 18, 191.
3. HOWARD N. J., and ELOESSER, LEO J. *Bone & Joint Surg.*, 1934, 16, Jan.
4. JONES, SIR ROBERT. *Irish J. Med. Sc.*, 1932, No. 78, 282.
5. KEY, J. A., and CALDWELL, H. E. *The Management of Fractures, Dislocations and Sprains*. St. Louis: C. V. Mosby Co., 1934.
6. ROBERTS, SUMNER M. *J. Am. M. Ass.*, 1932, 98, 367-373.
7. ROGERS, HOPATIO. *Surg. Gynec. & Obst.*, 1934, 59, 934.

PRIMARY CARCINOMA OF COWPER'S GLAND

ROBERT GUTIERREZ, A B, M D, F A C S, New York, New York

SURGICAL diseases of the Cowper glands have received but scant attention in urological practice, in fact, pathological conditions of these two minute organs up to the present time have been regarded as rare. Therefore, it is not surprising to find, upon looking over the literature of the subject, that only 5 cases of primary carcinoma of the Cowper glands are on record.

The frequency of pathological lesions of these bulbo-urethral glands must certainly have been underrated, since their anatomically strategic position in the perineum at the level of the membranous urethra, where their lubricating ducts open readily invites ascending infection in the most common type of urethritis prevalent in the male.

In gynecological practice infections of the Bartholin glands the homologues in the female of the Cowper glands in the male are of quite common occurrence and many cases of primary cancer of these glands have been reported. Clinical experience reveals however, that it is rather unusual for pathological conditions to be discovered primarily in the Cowper glands, either because their pre-operative diagnosis is seldom made, or because they are mistaken for some pathological condition of the urethra or prostate, and the true nature of the affection is often not recognized until after the operation when histological sections are made of the specimen removed. In fact there are many cases in which no specimen is obtained and the histological examination is not made.

The purpose of this study is to bring out the clinical importance of these pathological conditions of the lower urinary tract, which may be encountered in routine urological practice and which in many instances produce not only obstructive uropathies but also genital disturbances, demanding early surgical relief—conditions sufficiently common to make it important for the general surgeon and the urologist to bear them in mind when making a diagnosis.

This communication is based on the report of one personal case of primary carcinoma of Cowper glands diagnosed and operated upon by the author, with a review of the literature, and presented in the hope that this work will stimulate further research in this important field.

HISTORY AND LITERATURE

It appears that the two small organs commonly known as Cowper's glands were in reality first briefly described by Mery, a French surgeon, in the *Journal des Savants* of June, 1684. The original description, which amounted to something less than five lines spoke of "two small glands the size of a pea, which he had seen lying under the male organ, beneath the accelerator muscles, about a thumb's distance from the body of the prostate, and about 2 lines apart from each other." These structures could, of course, be nothing else than the bulbo-urethral glands, to which Cowper independently called attention in 1699, and of which he gave a more detailed description in 1702. Although certain French writers have assiduously tried to maintain the priority of their own countryman's discovery, by calling them "Mery's glands," it seems that Mery himself never pressed the matter and made no protest when Littré (1700), Morgagni and other contemporaries began to refer to them as Cowper's glands—a name that has now become inseparable from these organs. They have also been called 'the glands of Duverney, who mistakenly spoke of them as "inferior prostates" others of that period termed them "small prostates," "accessory prostates, adstuti conglomerati" (Terraneus, 1709) anuprostates (Winslow) and "round mucous glands" (Haller).

During the 18th century there was considerable confusion as to their number and their exact location with reference to the prostate and the urethra. Cowper, after describing two glands at the outset decided later that there were three and in this conclusion he was upheld by Lieutaud (1742) and Mauget (1746) both of whom thought they found something similar in one or two cases. This led Cruveilhier to make a very detailed search for a third gland but in the end that author announced that he could find no sign of any such structure. It seems probable, according to Guebler, that what Cowper and the others saw were accessory glandular granules such as some times are found accompanying the excretory ducts from the normal Cowper's glands, lying within the corpus spongiosum of the urethra. Cowper, in one of his drawings, it is true, showed an isolated duct coming from the third gland but as he failed to state in how many subjects he

observed this duct, we must conclude that its existence is exceptional and must be regarded as an anomaly.

Guebler, in 1849, published in a Paris thesis the most extensive study of "Mery's glands" (as he insisted on calling them) that had yet appeared,—a remarkable work embodying an exhaustive search of the literature of the subject as well as his own personal investigations carried out on 20 cadavers. It is to him that we are indebted for what is even today the most complete and authoritative account of the anatomic structure and topographic relations of these glands. With reference to their pathology, he wrote that "while nothing had been written except on inflammations and obliterations, there could be no doubt that with further study it would be found that they are subject to all the changes and diseases that other organs suffer,"—a statement well borne out by modern observations.

Guebler's work formed the basis for a comprehensive thesis from the pen of Lebreton in 1904, which brought the pathology of the glands up to date, and devoted many pages to a clear exposition of acute and chronic cowperitis.

A study of the literature up to the time of Lebreton reveals reports of only 3 cases of primary carcinoma of Cowper's glands. These were recorded by Paquet and Herrmann (1884), Pietrzykowski and Gussenbauer (1885) and Kocher and Kaufmann (1886). In recent years two more proved cases of this rare type of cancer have been reported, namely that of Di Maio in 1928, and that of Uhle and Archer in 1935. In one additional case reported by Blanc, Wies, and Carret (1910), a clinical diagnosis of primary carcinoma of Cowper's gland was made, but as the patient refused operation and was not seen again, the case, although of great interest, can unfortunately not be counted as authentic since it lacked histological confirmation.

Other important contributions in modern times to the study of Cowper's glands have been made by such German writers as Englisch, Elbogen, Halle and Motz, Hertwig and von Lichtenberg, in Belgium by Hogge, in France by Hartmann and Lecene, by Delbet, Pasteau, Nogues, Reyness, Leszczynski, Papin and Vafiadis, Luys and others, in the United States by Young, Keyes, Hinman, Lowsley and Kirwin, and Walters, and, more recently, by Uhle and Archer, who reported the first case of primary adenocarcinoma of the Cowper glands in America.

To the 5 cases in the literature in which the presence of primary carcinoma of Cowper's glands was proved by examination of the specimen, I am

here adding a sixth case of this very rare condition which I have recently had the opportunity of observing.

ANATOMY OF COWPER'S GLANDS

The Cowper glands are two small round or oval glands, frequently flattened, lying in the urogenital floor between the two layers of the median perineal aponeurosis, and between the deep surface of the bulb and the superficial surface of the membranous urethra, at the level of the triangular ligament and the apex of the prostate. In some individuals one or both of these glands may be lacking. Thus, Lebreton reports that, in a total of 15 fresh specimens examined, he saw both glands clearly in 9, in 4 he saw only 1, normally the gland on the left side, and in 2 neither gland at all could be found. Their size varies from that of a hempseed in the newborn to that of a cherry-stone or hazelnut in the adult. When the average glands are developed they are usually separated by a space of 4 to 5 millimeters (Sappey), but if larger than the average they may encroach upon one another and even present the appearance of a single large gland, sitting astride of the membranous urethra (Fig. 1). The two glands may be of the same size, but not infrequently the left is larger, suggesting a possible anatomic reason for the greater frequency of cowperitis on the left side. Deviations from the typical form, size, and position abound.

The glands are mucous, tubo-alveolar structures, racemose in their arrangement, they are of firm consistency, which renders them easy to grasp with the fingers before their complete dissection. Their terminal divisions, after a certain amount of branching, end in irregularly sacculated compartments. After denudation they are reddish in color when first seen through the very close capillary network that surrounds them, when this is removed they are yellowish, and very easy to recognize. They contain a clear and viscous secretion of alkaline reaction.

The excretory ducts that drain the glands are usually about 3 to 4 centimeters in length, and about 1.5 millimeter in diameter. Leaving the glands in a forward and median direction, they plunge into the bulb, through which they pass obliquely on their way to the urethra, which they approach very gradually, they finally become submucous and, after a tract of varying length, obliquely pierce the mucous membrane itself. We can, accordingly, distinguish two portions of the duct: (1) an intraspongious portion and (2) a submucous portion, the second being as a rule two or three times as long as the first. The ducts

tend to become tortuous at the point where they enter the urethra through two small slit like orifices (Fig 1), which may be difficult to see, especially in young subjects. Frequently one duct is considerably longer than the other, in which case the orifices are in the same anteroposterior but not in the same transverse line.

Microscopically, the alveoli of the glands are lined with low columnar or pyriform cells, with mucus secreting elements present in great number. The diverticula of the gland are united by intertubular connective tissue and are invested with a fibrous envelope containing both smooth and striped muscle fibers derived from the compressor urethrae muscle. The glands receive their blood supply from branches of the arteries of the bulb which terminate in capillaries that enclose the alveoli and diverticula.

EMBRYOLOGY

The Cowper glands are formed from the urogenital sinus at an early stage of embryonic life, and are the homologue in the male of the Bartholin glands in the female.

The embryological study of these glands dates from 1840, when Tiedman reported that he saw them in embryos of 5, 6, and 7 months. Since his time numerous authors have engaged in their study, and the date of their appearance has been carried back to as early as the tenth or eleventh week of embryonic life (Hoffmann, 1877). Mueller (1892) concluded that their first appearance is irregular as to time, and that it may take place in embryos from 4 to 8 centimeters in length. He states that the anlagen of both these glands arise first as solid buds from thickening of the epithelium of the urogenital sinus, which later on acquire a lumen. Lichtenberg in 1906 found gland buds unbranched in a 65 millimeter embryo, although both contained lumens, small lateral buds indicated the site of future branching. In an embryo of 70 millimeters an accessory Cowper's gland was present.

Eggerth (1915), who has given us a very detailed account of his observations, states that human embryos, both male and female, of 3 to 6 centimeters crown breech length, present 3 pairs of lateral folds on the wall of the urogenital sinus, which in the younger stages extend from the ostium urogenitalis to a point about halfway to the place where the mesonephric ducts enter the sinus. They appear first as solid epithelial ridges or folds, arranged symmetrically on the two sides of the urethral plate. In embryos of only 3 centimeters' length he was able to observe the anlagen of Cowper's and Bartholin's glands as solid epi-

thelial buds arising from the median lateral fold near its cephalic end. When the embryo reaches a length of about 4.5 centimeters, the distal portion of the bud develops a knoblike end with a narrower proximal portion in which the beginnings of a lumen can be seen. At 5 to 6 centimeters there is evidence of distal branching of the anlage, cross sections of the gland showing a partial division into 4 or 5 branches, each of these also precluding a lumen. He noted that the development of the glands on the 2 sides is not symmetrical either as to time or extent of growth.

Johnson made wax models of the Cowper glands as he observed them in early embryos (Fig 2). He traced the developments of the urethra and its various glands from the embryo of 55 millimeters to that of 220 millimeters, and demonstrated that the beginnings of Cowper's glands are already present in a stage at which the bulb itself is not yet apparent.

Anomalies of the Cowper glands are already observed in the fetal stages. Johnson found them in 3 of 15 embryos from 55 millimeters to birth. In 1 case the duct of the right side alone reached the urethra, the left being a branch of it which crossed the midline to reach the gland body. In the 2 other cases, the right and left ducts, respectively, were occluded at their outlets, resulting in a cystic condition from distention. There is no doubt that such anomalies may be responsible for pathological conditions of the Cowper glands appearing in adult life.

TUMORS OF COWPER'S GLANDS

The Cowper glands have until recently been so little known that their diseases, if we except cowperitis, have hardly appeared in the text books, but it is now recognized that they are subject to the same general processes of pathology as other organs of the body. The most important of these are (1) acute and chronic cowperitis, (2) cystic formations, (3) tuberculosis, (4) calculosis and (5) tumors. Our concern here is with the last named group alone. Lebreton in 1903 found records of only 3 cases of primary malignant tumor of Cowper's glands in the literature. These, as we have seen, were the cases of Paquet and Herrmann (1884), of Pietrzikowski (1885), and Kocher (in Kaufmann) (1886). In all these cases the existence of epithelial malignant tumors that had developed from the substance of Cowper's gland was established beyond question (Fig 3). In every one the histological examination proved that the tumors were carcinomas—that is, atypical epitheliomas developed from the epithelium of the acini of the gland, their structure recalling

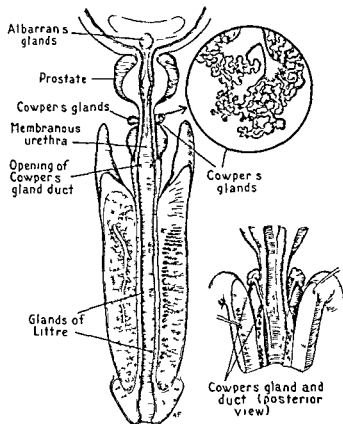


Fig. 1 Frontal section in diagrammatic form showing the topographic relationship of the Cowper glands and their ducts to the membranous portion of the urethra, also the interrelationships of the different urethral glands at various levels of the urethra. The circle on the right is a graphic representation of the racemose internal structure of the glands of Cowper. The drawing in the lower right corner is a schematic view of the posterior portion of the bulbomembranous urethra indicating the anatomic position of the Cowper glands and their corresponding ducts as they empty into the membranous urethra. (Modified drawing from Testut, Sappey, Toldt and others.)

absolutely that of a cylindroma. The histories of the second and third cases would seem to indicate that such tumors are of very great malignancy. In the second case, the subject was a youth only 19 years of age. In none of these cases was the exact diagnosis made previous to surgical intervention.

In 1910 Blanc, Wies, and Carret reported a case on which they were not permitted to operate, but which was clinically diagnosed by them as carcinoma of Cowper's gland, on the basis of a hard, painless, infiltrated mass lying in the median perineal region, unaccompanied by any urinary disturbances, but associated with a few hard, painless nodules in both groins. However, as the patient refused operation and left the hospital after 6 days' observation, this case can, unfortunately, not be counted among verified instances of carcinoma of the Cowper glands.

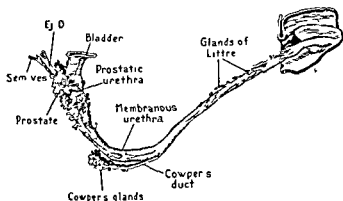


FIG. 2 Reconstruction of the glands of the urethra in a wax model from an embryo, after Johnson, showing the anatomical position of the Cowper glands and the Cowper ducts at the level of the membranous urethra in an early stage of embryonic life.

In 1928 Di Maio reported a fourth case, confirmed by biopsy, in which a malignant growth of the Cowper gland was present. Here there were no symptoms within the urinary tract and the endoscopic findings were negative. There was no external tumefaction, but, upon rectal examination, a large mass could be felt. The patient was a cavalryman who was used to sitting in his saddle all day, and as the growth went on the discomfort of this amounted to torture. This pain and the appearance of urethral hemorrhages brought him for examination earlier than he might otherwise have come, and thus made possible the diagnosis, at a comparatively early stage, of a malignant growth associated with hemorrhagic cysts of Cowper's gland.

Quite recently (1935) Uhle and Archer have reported a fifth proved case of carcinoma of Cowper's gland which they observed in Randall's service in Philadelphia. Here the patient was only 32 years of age, and the case was marked by the finding of a normal prostate, a complete absence of urinary symptoms, and the presence of knife-like pain in the rectum, leading to the discovery of a firm, tender nodule just inside the internal sphincter. Histological examination of the excised tumor mass revealed an adenocarcinoma of the Cowper glands.

To these 5 cases I am now adding a sixth case that has recently come under my notice, and upon which I have had the opportunity to operate.

REPORT OF AUTHOR'S CASE

A case of primary carcinoma of the Cowper glands in a man 70 years of age, who had been suffering for over 40 years with a genito urinary condition which had been erroneously diagnosed on several occasions and for which he had undergone extensive treatment, including several operations without relief. He was born with a right undescended testis and a very small meatus, for which a meatot

tend to become tortuous at the point where they enter the urethra through two small slit like orifices (Fig. 1), which may be difficult to see especially in young subjects. Frequently one duct is considerably longer than the other, in which case the orifices are in the same anteroposterior but not in the same transverse line.

Microscopically, the alveoli of the glands are lined with low columnar or pyriform cells, with mucus secreting elements present in great number. The diverticula of the gland are united by intertubular connective tissue and are invested with a fibrous envelope containing both smooth and striped muscle fibers derived from the compressor urethrae muscle. The glands receive their blood supply from branches of the arteries of the bulb which terminate in capillaries that enclose the alveoli and diverticula.

EMBRYOLOGY

The Cowper glands are formed from the urogenital sinus at an early stage of embryonic life, and are the homologue in the male of the Bartholin glands in the female.

The embryological study of these glands dates from 1840 when Tiedman reported that he saw them in embryos of 5, 6, and 7 months. Since his time numerous authors have engaged in their study, and the date of their appearance has been carried back to as early as the tenth or eleventh week of embryonic life (Hoffmann 1877). Mueller (1892) concluded that their first appearance is irregular as to time and that it may take place in embryos from 4 to 8 centimeters in length. He states that the anlagen of both these glands arise first as solid buds from thickening of the epithelium of the urogenital sinus, which later on acquire a lumen. Lichtenberg in 1906 found gland buds unbranched in a 65 millimeter embryo although both contained lumens, small lateral buds indicated the site of future branching. In an embryo of 70 millimeters an accessory Cowper's gland was present.

Eggerth (1915) who has given us a very detailed account of his observations, states that human embryos both male and female, of 3 to 6 centimeters crown breech length present 3 pairs of lateral folds on the wall of the urogenital sinus which in the younger stages extend from the ostium urogenitale to a point about halfway to the place where the mesonephric ducts enter the sinus. They appear first as solid epithelial ridges or folds, arranged symmetrically on the two sides of the urethral plate. In embryos of only 3 centimeters' length he was able to observe the anlagen of Cowper's and Bartholin's glands as solid epi-

thelial buds arising from the median lateral fold near its cephalic end. When the embryo reaches a length of about 4.5 centimeters the distal portion of the bud develops a knoblike end with a narrower proximal portion in which the beginnings of a lumen can be seen. At 5 to 6 centimeters there is evidence of distal branching of the anlage, cross sections of the gland showing a partial division into 4 or 5 branches, each of these also precluding a lumen. He noted that the development of the glands on the 2 sides is not symmetrical either as to time or extent of growth.

Johnson made wax models of the Cowper glands as he observed them in early embryos (Fig. 2). He traced the developments of the urethra and its various glands from the embryo of 55 millimeters to that of 2.0 millimeters and demonstrated that the beginnings of Cowper's glands are already present in a stage at which the bulb itself is not yet apparent.

Anomalies of the Cowper glands are already observed in the fetal stages. Johnson found them in 3 of 15 embryos from 55 millimeters to birth. In 1 case the duct of the right side alone reached the urethra the left being a branch of it which crossed the midline to reach the gland body. In the 2 other cases the right and left ducts, respectively, were occluded at their outlets, resulting in a cystic condition from distention. There is no doubt that such anomalies may be responsible for pathological conditions of the Cowper gland appearing in adult life.

TUMORS OF COWPER'S GLANDS

The Cowper glands have until recently been so little known that their diseases, if we except cowpitis have hardly appeared in the text books but it is now recognized that they are subject to the same general processes of pathology as other organs of the body. The most important of these are (1) acute and chronic cowpitis, (2) cystic formations, (3) tuberculosis, (4) calculus and (5) tumors. Our concern here is with the last named group alone. Lebreton in 1903 found records of only 3 cases of primary malignant tumor of Cowper's glands in the literature. These, as we have seen were the cases of Paquet and Herrmann (1884), of Pietrzikowski (1885) and Kocher (in Kaufmann) (1886). In all these cases the existence of epithelial malignant tumors that had developed from the substance of Cowper's gland was established beyond question (Fig. 3). In every one the histological examination proved that the tumors were carcinomas that is atypical epitheliomas developed from the epithelium of the acini of the gland, their structure recalling

possible malignant growth of the Cowper glands. The prostate, which was enlarged to about three times its usual size, was situated far behind these hypertrophic masses of the Cowper glands, and was of leathery consistency and adenomatous in type. The right and left seminal vesicles were slightly palpable but apparently normal. No prostatic fluid was obtained for microscopic examination. The urine test showed the first glass clear, with shreds, second glass clear, third glass hazy. The urethra was permeable to a No. 14 silk catheter, and a No. 20 French sound which was passed with slight difficulty. The patient had 1 ounce of residual urine. In view of the marked sensitivity of the urethra further instrumentation was postponed in order to relieve the acute symptoms from which he was suffering.

Impression (1) Right undescended testis (2) Chronic cowperitis with marked hypertrophy and induration of these glands accompanied by cysts and stone formation, with possibility of a malignant growth. (3) Adenomatous hypertrophy of the prostate. (4) Stricture of the urethra.

At this time the patient refused operation and was satisfied to receive palliative office treatment of his urologic conditions, although he was informed that the Cowper glands, which were responsible for all the urinary and rectal symptoms with which he had been suffering for so many years, would sooner or later involve the external sphincter of the urethra and induce an attack of complete retention of urine (Fig. 3).

On Sunday March 20, 1936 the expected attack of retention came. I was called early in the morning by the patient's wife who stated that her husband was unable to urinate and had been suffering intensely all night with pain in the suprapubic region and marked bladder and rectal tenesmus. After I had relieved the acute retention of urine I proposed a consultation with his family physician and also with another urologist to substantiate my findings which was agreed to.

Röntgenographic and urographic examinations were carried out. The plain film was entirely negative with reference not only to Cowper's gland pathology but to shadow indicative of stone anywhere in the urinary tract. After the intravenous administration of 20 cubic centimeters of Iopax, x-ray pictures were taken revealing that both kidneys had good eliminatory function and that they were normal in size, shape and position. The pelvis, ureters and bladder were also well outlined and normal. Urethrocytograms in both anteroposterior and lateral views disclosed that the entire lumen of the urethra and the bladder were distended with the opaque substance but were negative to the presence of pathology in the Cowper glands.

April 1, 1936. After making a rectal examination Dr. Alfred T. Osgood, called in consultation agreed with my findings that the attack of acute retention of urine might have been due to this hypertrophy and induration in the Cowper glands and wholly independent of the prostate. He also recommended that the patient be hospitalized with a retention catheter and that these hypertrophied indurated Cowper glands be removed by way of the perineum. The family physician, Dr. Laurence W. Whittemore also agreed with this recommendation and the patient was finally admitted to the hospital for operation.

The interior of the bladder was found negative on cystoscopic examination except that there was a small amount of bulbous edema at the floor of the bladder neck, probably caused by the retention catheter. Upon withdrawing the instrument a slight lateral prostatic intrusion was seen, indicating a moderate degree of prostatic hypertrophy, but not sufficient to account for the obstruction. The rest of the urethra was carefully examined and was apparently

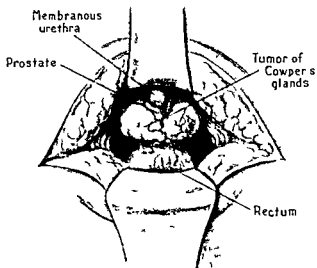


Fig. 5 Operative technique of perineal cowperectomy, showing the intimate relationship of the infiltrating tumor mass of Cowper's glands strongly adherent to the rectal wall and to the membranous portion of the urethra. After total removal of this indurated mass by the perineal route the prostate lay directly behind separated by Denonvillier's fascia which served as a plane of cleavage to prevent invasion of the prostate by the malignant growth thus indicating the value of early perineal total cowperectomy.

negative. The two orifices of the Cowper glands ducts were not seen. With these negative cystoscopic findings the patient was prepared for the operation of perineal cowperectomy.

TECHNIQUE OF PERINEAL COWPERECTOMY

After administration of spinal anesthesia the patient was placed in the exaggerated lithotomy position as in perineal prostatectomy. With the usual preparation the long seminal vesicle urethral tractor was passed into the bladder without difficulty, a curved incision was made in the perineum, from one ischial tuberosity to the other between the scrotum and the rectum. The incision was carried deeper on each side of the midline into the ischio-rectal fossa, by blunt dissection, the central tendon was then divided, allowing the bulbar portion of the urethra to be retracted, and some remaining fibers of the rectourethral muscle were dissected and cut with scissors. At this time it was recognized that there was a considerably indurated and hypertrophic mass of tissue which occupied the entire floor of the perineum, and which because of its close attachment to the membranous bulbar portion of the urethra and to the rectal wall was quite difficult to isolate. A finger was then inserted into the rectum to serve as a guide during the further dissection of this hardened and almost calcified tissue and also to protect that viscus



Fig 6 Photomicrograph of an area of the specimen removed at operation revealing an atypical neoplastic proliferation of the acinous portion of the Cowper glands. $\times 70$

from injury. After slight difficulty in advancing the dissection a perineal retractor was placed in the perineum to give proper protection to the rectal wall the index finger was withdrawn from the rectum and the gloves were changed. At this time clamps were placed here and there to stop bleeding and ligatures were made.

With further dissection of the perineum, the tumor masses that were attached on each side of the rectum were separated and entirely freed from their attachment to the wall of the rectum (Fig 5). These two masses were about the size of two large olives of irregular shape, and hard as a rock they appeared to be surrounded by cyst formation and some calcifications. While an Allis clamp was being placed in the growth, a few drops of green pus were seen, of which cultures were made. These hard masses were clearly separated from the prostate gland, and although close to it were not in the least attached to it. It was evident that there was a perfect line of cleavage between this growth of the Cowper glands and the prostate itself. Apparently the prostatopentoneal aponeurosis, or Denonvillier's fascia was acting as a diaphragm or protecting membrane to prevent the invasion of the prostate gland. Although this growth was firmly attached to the membranous urethra where the Cowper gland ducts were anatomically situated, the urethra itself had not been invaded. After the hard tumor masses of the Cowper glands were entirely removed and a total cowperectomy accomplished the prostate could be felt all the way around, showing that there were no adhesions to the rectal wall. However as there was some induration on the posterior and right lateral lobe

it was decided to remove a piece for histological examination, otherwise the prostate gland was not disturbed. At no time during the procedure was the membranous urethra opened or injured.

After proper cleansing and insertion of a few hot compresses to stop oozing, the wound was reexamined to assure that no pieces of the growth of the Cowper gland had been left behind after which with the clinical impression of definite carcinoma of Cowper's glands it was closed in the usual manner. The floor of the perineum was closed, bringing the two levator ani muscles together with chromic catgut sutures, and the skin was closed with interrupted silk worm gut sutures a cigarette drain being placed on the right side. A retention catheter No. 22 was then passed into the urethra without difficulty the bladder was irrigated and the return fluid was pinkish but rather clear. The catheter was fixed in position and the patient returned to his room in good condition.

The patient's convalescence was uneventful up to the sixth day the perineal wound was dressed daily the packing was removed at the end of 48 hours, the catheter irrigated daily with silver nitrate 1:10,000 and on the sixth day removed, since the patient was complaining of pain in the urethra. The stitches were removed on the sixth postoperative day and the perineal wound which was healthy and clean was packed lightly with balsam of Peru to stimulate granulation and prompt healing of the entire wound.

April 16, 1936 Twelve days after operation while the patient was recuperating from his perineal cowperectomy he suddenly developed a chest complication in his left lung for which Dr. Whittemore, Dr. William R. Williams, and Dr. James Morley Hitzrot were called in consultation. The first x-ray films were negative 2 days later x-ray films were repeated and showed the presence of fluid in the left pleural cavity which went on to the formation of an empyema. After 3 different tapplings each of which elicited some 400 cubic centimeters of pus a thoracotomy was done by Dr. Hitzrot under local anesthesia on April 18th and a large rubber tube was introduced into the lung for drainage. The patient bore the operation well, but on the following day his condition became worse. Innumerable attempts were made to save his life but all proved vain and on April 20 death supervened as the result of general sepsis arising from the empyema. The specimen removed at operation consisted of several pieces of hard indurated glandular tissue which corresponded to the firmly adherent and infiltrated growth removed from the perineum and submitted to the pathologist for histological examination. The report of the pathologist, Dr. James Ewing submitted on April 24, 1936 was of great interest, in that the microscopic study showed an infiltrated, malignant grade 2 plus adenocarcinoma involving all parts of the Cowper gland material submitted with a slight tendency to the development of cysts within the growth of papillary adenocarcinoma (Figs. 6 and 7). Many of the areas of the neoplastic mass showed very wide adenocarcinomatous acini delimited by a network of epithelial strands. In some areas there were elongated papillary structures with thin strands of stroma lined by opaque cubical epithelium with atypical features not met with in prostatic cancer. In another area the tumor took the form of very numerous small regular acini

lined by opaque cells. In other portions there were peculiar compact medium sized acini, lined by rather large granular cells. On the whole, Dr Ewing said the structure of the adenocarcinoma was quite consistent with an origin from the Cowper glands.

Pathological diagnosis adenocarcinoma of Cowper's glands

The study of this case report suggests several possible hypotheses with reference to the underlying etiology responsible for the formation of primary adenocarcinoma of the Cowper glands. It serves also to bring out the difficulties in diagnosis and to point out the many years of suffering and unnecessary surgical treatment which this patient had undergone because of erroneous diagnosis.

First of all, it appears that the "orthostatic albuminuria" from which he was suffering in his early youth and on account of which he was rejected in a life insurance examination for Bright's disease, was nothing but the presence of mucin coming from an undiagnosed cowperitis. It is logical to assume that in cases of cowperitis following urethritis the Cowper glands will excrete an excess of glandular fluid, and, as Henle and other early investigators have demonstrated, the fluid from the Cowper glands contains an excessive amount of albuminoid substance, which can be readily detected in a routine urinalysis. In this instance this was clearly the case, for the patient lived to be 70 years of age and the intravenous urograms that I took revealed that both kidneys were entirely normal. It is obvious that the symptomatology in these cases is often misleading, particularly when these patients most commonly complain of rectal symptoms and go first to the family physician and the proctologist for relief. This case history reveals that the patient had had 3 operations for hemorrhoids and 2 dilatations of the rectum made under general anesthesia in the last 10 years, when in reality the underlying cause of his trouble was the presence of an undiagnosed pathological condition of the Cowper glands.

An analysis of the 5 cases collected from the literature and reported in resume in the attached table (Table I) reveals that all of these patients with primary carcinoma of Cowper's glands are complaining of a syndrome characterized mainly by pain in the rectum, a tumor mass in the perineum and presence of urinary disturbances, for which they finally come to the urologist for examination.

Although the etiological factors in the new growth formation are at present not definitely known, it can be assumed in this case that, as a result of the pathological changes produced by



Fig 7 Photomicrograph of another section of the specimen removed at operation, showing the characteristic features of adenocarcinoma of Cowper's glands $\times 125$

infection of the Cowper glands in early life, there had been an obliteration of the Cowper duct with ectasia and cyst formation, as well as calcification or possible stone formation of the glands and their ducts. The lack of drainage and the persistent interstitial inflammation, together with the absence of any proper capsule of the organs, and the fact of the constant trauma to which these glands are subjected in the perineum, may lead to the formation of a new-growth of infiltrating character, spreading into the tissues of the perineum and the entire periglandular region. In 2 of the cases, namely the one reported by Pietrzikowski and my own case, the tumor mass had extended upward and involved the external sphincter, finally resulting in complete retention of urine.

The age incidence of these 6 authentic cases was 65, 19, 57, 65, 32, and 70 years, showing that this malignant growth may develop in Cowper's glands at any age.

The trauma incident as the primary cause in the etiology of the formation of cancer was evident in Kocher's case, since the patient had had a straddling injury of the perineum 12 years previous to the appearance of the tumor. In most of the cases reported the growth was of infiltrating character and was firmly adherent to the bulbomembranous portion of the urethra, as well as plastered to the lower portion of the rectal wall, so that in the surgical treatment, as in the cases of Paquet, Kocher, Di Maio, and Uhle and Archer, dissection of the perineum was very laborious and a partial section of the adherent portion of the bulb to which the tumor was

TABLE I—SUMMARY OF CASES OF PRIMARY ADENOCARCINOMA OF COWPER'S GLANDS COLLECTED FROM THE LITERATURE

No	Author	Symptoms	Clinical diagnosis	Pathologic findings	Operation	Result	Remarks
1 85	Paquet and Herrmann 1884	Small perineal tumor on palpation. Slight urinary distur- bances early. Intense pain on defecation	Hypertrophy of Cowper's glands	Epithelioma of Cowper's gland	Removal of Cowper's glands	Cured (2 yrs later)	Tumor adherent to bulb which was par- tially resected leav- ing urinary fistula
2 19	Pietrzkowski and Lu sen- bauer 188	Hard tumor about size of egg on pal- pation of perineum Late urinary sym- ptoms. Retent on Pain on defecation	Hard tumor of perineum	Carcinoma of Cowper's glands metastasis to inguinal lymph nodes	Excision of tumor of Cowper's gland and of inguinal glands	Recurrence within a few months. Death	
3 57	Kocher 1885	Perineal pain worse on sitting or walk- ing. Slight dysuria frequency and burning	Hard tumor surrounding the membranous urethra and unrelated to prostate	Carcinoma con- taining debris of Cowper's glands	Median incision along raphe Complete excision with excision of part of membranous urethra	Recurrence 17 months later Small perineal tumor size of pea removed. Cured for 3 yrs	Injury in perineum 12 years previous to appearance of tumor
4 65	Di Maio 1918	Severe pain in peri- neum. Hemorrhages from urethra. Tu- mor of insidious be- ginning about size of hen's egg. Dis- covered on rectal examination	Probable cyst of prostate	Adenocarcinoma of Cowper's gland	Wide perineal in- cision with removal of tumor of Cowper's gland	All symptoms relieved wound closed in 3 wks No further repair	Tumor was hard unrounded. Ex- cysts infiltrating the bulb and floor of perineum
5 32	Uhle and Archer 1915	Sharp knife-like pain in rectum 6 months duration. Marked constipation. Fis- tula in anal mass in perineum	Tumor mass in perineal region	Adenocarcinoma of Cowper's gland	Excision of perineal tumor mass fol- lowed by radium seeds and deep x-ray treatments	Good condition 1 year later	Treated for fistula also
6 70	Gutierrez 1916	Dysuria albuminuria frequency. Reten- tion. Pain in peri- neum and rectum tumor mass in peri- neum on rectal palpation	Tumor of Cowper's glands	Adenocarcinoma of Cowper's glands	Total perineal Cowperectomy	22 days after operation death from general sepsis following an empyema of pleural cavity	Treated for hemor- rhoids. Structure of urethra. Prostatic trouble. Operated upon 3 times for arterial hemor- rhoids twice for dilatation of rectum

attached was also removed. It is to be noted that in instances in which the urethra has been opened as in Cases 1 and 5 of the accompanying table a urinary fistula had persisted for some time, which is rather a characteristic feature of all malignant tumors of the perineum and lower urinary tract.

The clinical diagnosis of any pathological condition of the Cowper glands is very seldom made unless one thinks of the possibility of its existence. A tumor of these glands may readily be mistaken for stricture of the urethra, periurethral or perineal abscess, diverticulum of the urethra, calcified cyst or stone or tuberculosis not only of the urethra but also of the prostate. The final diagnosis must be made on the histological section of the specimen removed at operation, as the only way to establish its authenticity.

Routine roentgenographic examination as well as urethrocytography may be of value in diagnosis of pathological conditions of the Cowper glands, particularly when the Cowper ducts are patent and the condition can be outlined by the

injection of a contrast medium. The author recently had an opportunity to see in the Urological Service of the Hôpital Cochin of Prof. Chevassu in Paris a beautiful case of tuberculosis of the Cowper glands urethrographically diagnosed. Of course in all these cases the routine urethroscopic examination should always be made so that even if a diagnosis of Cowper gland pathology cannot be reached, it may at least be possible to rule out other pathology of the prostatic urethra or at the bladder neck.

The classic routine rectal examination is the most important way of establishing the clinical diagnosis (Fig. 4). It may be helpful to repeat this examination after placing a sound in the urethra so that the entire urethral canal can be palpated and a Cowper gland condition readily differentiated from any other lesion of the lower urinary tract.

The prognosis of primary cancer of the Cowper glands is very grave. An analysis of the cases reported up to the present time shows that none of them has met the test of a 5 year cure.

As regards treatment, a study of the 6 cases reported in the literature indicates that as soon as the diagnosis is made there should be a total perineal cowpextectomy without opening the membranous urethra or injuring the rectum. The steps in the technique of this operation, which has been discussed here in detail, are the same as those that the author has used in more than 200 consecutive cases of perineal prostatectomy and seminal vesiculectomy.¹² As soon as histological examination of the specimen removed has proved the presence of a malignant growth, the operation should be followed by implantation of radium seeds in the perineum and by deep x-ray treatments, as was done in the recent case of Uhle and Archer, in which the patient appears to be in good condition 1 year after operation. In my own case here reported the radiation treatment was not used on account of the fatal complications that developed 12 days after operation.

SUMMARY AND CONCLUSIONS

The purpose of this presentation is to place on record a new case of primary adenocarcinoma of Cowper's glands, clinically diagnosed and operated on by the author and confirmed by histological examination.

The literature has been reviewed. Only 5 previous cases of this kind have been reported, all of which are here tabulated and summarized, together with the author's case, in Table I.

The study has revealed that while pathological conditions of the Cowper glands are rarely diagnosed clinically, their incidence must have been greatly underestimated since the strategic anatomical position of these glands in the perineum at the level of the membranous urethra invites ascending infection with potential sequels of surgical pathology.

The symptomatology in carcinoma of the Cowper glands is readily confused with conditions of the rectum and lower urinary tract. The cardinal symptoms are pain in the rectum and perineum, tumor mass in the perineum, and urinary disturbances which may go so far as to produce complete retention.

The treatment when the clinical diagnosis is established is the complete removal of the growth by a total perineal cowpextectomy followed by implantation of radium seeds and deep x-ray treatment.

The prognosis is very grave, no case having yet met the test of a 5 year cure. It may be assumed, however, that with early diagnosis and the institution of proper surgical treatment better results will be obtained.

REFERENCES

1. ALBARRAN, J. and LEGUEU F. *Maladies de l'urètre*. In *Traité de Chirurgie*. By Le Dentu and Delbet pp 273-318. Paris J B Baillière et fils 1900.
2. BLANC, WIES and CARRUT. Cancer des glandes de Cowper. *Loire méd*, St Étienne 1910 29 375-379.
3. COHEN H and DOURMASHKIN, R I. Chronic cowpextitis. *Urol & Cutan Rev*, 1923 27 151.
4. COULIARD J. Contribution à l'étude des affections des glandes bulbo urétrales. Thèse de Paris, 1876.
5. COWPER, W. Two new glands near the prostate gland, with their excretory ducts, lately discovered. *Philos Tr Lond*, 1699 p 258 1700, pp 194-197.
6. Idem. *Glandularum quarundam nuper detectarum descriptio*. London 1702.
7. CROUSE, HUGH W. Retention cysts of Cowper's ducts. *Bull Fl Paso Co Med Ass* 1911 September 18.
8. CRUVEILLIER J. *Anatomie pathologique du corps humain*. Paris J B Baillière 1829.
9. DEBIERRE, C. Développement de la vessie de la prostate, et du canal de l'urètre. Thèse de Paris Doin, 1883.
10. DELBET P. *Urètre*. In *Anatomie humaine*. By Poirier Charpy. Paris, 1901.
11. DI MAIO G. Cancro primitivo della glandola di Cowper. *Gazz d osp* 1928, 49 1012-1017.
12. DOBLE, F C. *The Urethra and the Urethroscope*. Oxford Med Pub. London 1923.
13. EGGERTH A H. On the anlage of the bulbo urethral and major vestibular glands in the human embryo. *Anat Rec* 1915 9 191-206.
14. ELBOGEN, A. Zur Kenntniss der Cystenbildung aus den Ausführungsgängen der Cowper'schen Drüsen. *Ztschr f Heilk* 1886, 7 221.
15. ENGLISH, J. Ueber Retentioncysten der Zuführungsgänge beider Cowperschen Drüsen. *Tagebl d deutsch Naturforsch u Aerzte*, 1881 34 148.
16. Idem. Ueber Obliteration und Erweiterung der Ausführungsgänge der Cowper'schen Drüsen. *Med Jahrb* 1883 pp 289-308.
17. Idem. Ueber chronische Geschwülste und Fisteln der Cowperschen Drüsen. *Wien Klin Rundschau* 1893, 69 694-696.
18. ESCAT. Rôle des glandes de l'urètre dans les supurations périurétrales. *Ann d mal d org génito urin* 1904 p 1761.
19. FELIX W. Development of the urogenital organs. In *Human Embryology*. By Keibel and Mall 1910, vol 2.
20. GRASSIN. Contribution à l'étude de la cowpérite et de la péri cowpérite aiguës. Thèse de Paris, 1886.
21. GRUGET A. De la fistule de la glande de Cowper. Thèse de Paris 1876.
22. GUEBLER A. Des glandes de Mery et de leurs maladies chez l'homme. Paris 1849.
23. GUÉPIN. Exploration de la glande de Méry. *Tribune med Par* 1896 28 489.
24. GUTERER, R. *Textbook of Urology*. Vol 2 p 497. New York D Appleton & Co., 1918.
25. GUTIERREZ, R. Later results of surgery of the seminal vesicles. Report of one hundred consecutive seminal vesiculectomies. *J Am M Ass* 1929 93 1944-1951.

¹Gutierrez R. Later results of surgery of the seminal vesicles. Report of one hundred consecutive seminal vesiculectomies. *J Am M Ass* 1929, 93 1944-1951.

¹²Idem. Surgery of the seminal vesicles ampullae and vasa deferentia. *Oxford Loose Leaf Surgery*. Vol 3 pt 2 pp 301-309. New York Oxford University Press 1935.

- 26 Idem Transurethral treatment of bladder neck obstructions Endoscopic prostatic resection In History of Urology Chap 5 vol. 2 pp 137-186 Baltimore Williams & Wilkins Company 1933
- 27 Idem Surgery of the seminal vesicles ampullae and vasa deferentia In Oxford Loose Leaf Living Surgery Chap 9 vol. 3 pp 300-309 New York Oxford University Press 1935
- 28 Idem Surgery of the Seminal Vesicles In Cabot's Modern Urology 3d ed chap 17 vol 1 pp 613-647 Philadelphia Lea & Febiger 1936
- 29 HAAS J Contribution à l'étude des cowpérites dans l'uretrite chronique Thèse de Paris 1906-1907 No 2,6
- 30 HALLE N and MORTZ B Tuberculose de l'uretre postérieure Ann d mal d org génito-urin 1903 21 481
- 31 HALLER Cited by Lebreton
- 32 HARTMANN H and LÉCÈVE P La tuberculose de la glande de Cowper Compt rend de l'Ass franç d urol 1902 6 ses p 237
- 33 HERTWIG O Die Elemente der Entwicklungslehre des Menschen und der Wirbeltiere 6th ed Jena G Fischer 1920
- 34 HINMAN F The Principles and Practice of Urology Philadelphia W B Saunders Co, 1933
- 35 HOFFMANN G Lehrbuch der Anatomie des Menschen Erlangen Bd 1 part 2 p 695 1877
- 36 HOGGE A Recherches sur les muscles du périnée et du diaphragme pelvien sur les glandes dites de Cowper et sur la development de ces organes Ann d mal d org génito-urin 1904 22 1041 1121 and 1201
- 37 HOROVITZ M Die Krankheiten der Cowper'schen Druesen In Klin Handbuch der Harn u Sexualorgane By Suetzer Vol 3 pp 298-300 Leipzig 1894
- 38 JOHNSON F Later development of the urethra in the male J Urol 1920 4 447-501
- 39 Idem The homologue of the prostate in the female J Urol 1922 8 13-33
- 40 Idem Diverticula and cysts of the urethra J Urol 1923 10 295-310
- 41 KAUFMANN Verletzungen und Krankheiten der maennlichen Harnroehre Deutsche Chirurgie Lief 40 Stuttgart 1886
- 42 KEYES E L Urology New York D Appleton & Co 1928
- 43 KOCHER Cited by Kaufmann In Deutsch Chir 1886 50 164
- 44 LACQUIERE and BOUCHARD Cowperite calculeuse J d urol 1926 22 47-48
- 45 LEBRETON P Contribution à l'étude des glandes bulbo-urétrales et leur maladies Thèse de Paris 1903 1904 p 239
- 46 LESZCZYŃSKI R Sur la cowpérite chronique latente Ann d mal ven 1922 17 416
- 47 LICHTENBERG A von Beitrage zur Histologie mikroskopische Anatomie und Entwicklungsgeschichte des Urogenitalkanals des Mannes und seiner Druesen Anat Hefte Bd 31 1906
- 48 LIETAUD J Essais anatomiques Paris, 1742
- 49 LITTRE Sur la description de l'uretre de l'homme Mem Acad roy d sc 1702
- 50 LOWSLEY O S and KIRBY T J Textbook of Urology pp 358-375 Philadelphia Lea & Febiger 1926
- 51 LUIS G Traité de la blennorrhagie et de ses complications 3d ed Paris Doin 1921
- 52 LALE H H Primary carcinoma of the Bartholin gland Ann Surg 1934 100 993-995
- 53 MALGET J J Theatrum anatomum. Geneva 1716
- 54 MÉRY J Cited by Lebreton J d savants, 1684, No 17 p 304.
- 55 MORAGNI Adv anat 4 an 13, Leyden 1741
- 56 MORRIS Human Anatomy Chapter by Jackson C M 8th ed Philadelphia P Blakiston's Sons 1929
- 57 MORTZ B and BARTINA J M Contribution à l'étude des abcès périnéaux et des phlegmons diffus d'origine urétrale Ann d mal d org génito-urin 1903 21 1601
- 58 MUELLER V Ueber die Entwicklungsgeschichte und feinere Anatomie der Bartholini'schen und Cowper'schen Druesen des Menschen Arch f mikr Anat. 1892 vol 39
- 59 NICOLLE De la cowpérite Thèse de Paris 1893
- 60 NOGÈS P Inflammations des glandes de l'uretre cowpérites In Encycl franç d urol 1922 5 351-367
- 61 OZENNE Cowperite bilatérale grave chez un bicycliste Ann d mal d org génito-urin 1901 p 1233
- 62 PAPIN and VAFIADIS Tuberculose primitive de la glande de Cowper Bull. Soc franç d urol 1927 1 84 J d urol. 1922 13 280-282
- 63 PAQUET and HERMANN G Sur un cas d'epithelioma de la glande de Cowper J de anat. et physiol 1884 20 615
- 64 PASTEAU O Les cowpérites dans l'uretrite chronique Compt rend de l'Ass franç d urol 1906 10 261
- 65 PETIT L H Sur la découverte des glandes bulbo-urétrales par Jean Méry Union med Par 1853, 34 803
- 66 PIERCE L Normal Histology Chapter by Addison W H F P 283 14th ed Philadelphia J P Lippincott Co 1927
- 67 PIETRZIKOWSKI E and GUSSENBAUER Ein Fall von primarem Carcinom der Cowper'schen Druesen. Ztschr f Heilk 1883, 6 521
- 68 RELIQUET and GUYÉRY Symptomes de la cowperite traitement. Ann de méd scient. et prat 1893, 5 273
- 69 REYNÈS H Cowpérite chronique fi.tulo-périnéale etc Ass. franç d urol 1908 12 236
- 70 SAPPET M P C Traité d'anatomie descriptive 2d ed 1873 vol. 4 p 622
- 71 TERRANEUS De glandul ad urethr Turin 1709
- 72 TESTUT L Anatomia Humana Vol 4 pp 793-797
- 73 THOMSON D Gonorrhea London Oxford University Press 1923
- 74 TIEDEMANN F von den Duvernoy'schen Bartholini'schen oder Cowper'schen Druesen des Weibes Heidelberg und Leipzig Quoted from V Mueller 1840
- 75 TUFFIER Ab-cès des glandes de Cowper simulant un rétrécissement de l'uretre Bull. Soc anat. de Par 1883 58 469-482
- 76 UHLE C W and ARCHER G F Primary carcinoma of Cowper's glands J Urol. 1933, 34 128-133
- 77 WALTHER, H W Cowper's glands. Oxford Loose-Leaf Living Surgery Vol 3 pt. 2 pp 937-966
- 78 WALSCH Cowperitis gonorrhoeica Handb d Gesch lecht.kr Leipzig und Wien 1911 Vol 6 pp 830-860
- 79 WINSLOW Expose anat du corps humain Vol 4 p 48
- 80 YOUNG H H Practice of Urology Philadelphia W B Saunders Co 1926

THE ELLIOTT TREATMENT AS AN ADJUNCT TO 'OPERATION IN SIGMOIDAL DIVERTICULITIS

JOHN deJ PEMBERTON, M D, F A C S, and JOHN M WAUGH, M D, Rochester, Minnesota

IT IS generally accepted among surgeons that the management of diverticulitis of the colon in its surgical phases is a most difficult problem. Especially is this so if the process be complicated by a fistula between the colon and bladder. Dr W J Mayo, in discussing vesicocolonic fistulas, said "I know of no more trying operations than some of this character." Because of the marked inflammatory reaction which is commonly present in the involved segment of the colon, as well as in the adjacent tissues, primary resection of the affected portion of the bowel cannot usually be safely performed. Therefore, complete diversion of the fecal current by means of a primary colostomy for the purpose of placing at rest the inflamed segment of the bowel is commonly, for reasons of safety, a necessary procedure. By placing the affected segment of the colon at rest for several months, it has been our experience that marked subsidence of the inflammatory reaction usually occurs. In a few instances the subsidence of the inflammation in both the pericolic tissues and in the colon itself is so complete as to permit the closure of the colonic stoma without inducing a reactivation of the inflammatory process. However, in the great majority of cases the subsidence of the inflammatory process is not complete but is sufficient to permit resection of the affected portion of the bowel. In still another group of cases, fortunately small, there occurs no apparent subsidence of the inflammatory process, even after the bowel has been placed at complete rest for many months. Recently, several months after a colostomy had been performed on a patient with such a condition complicated by a vesicocolonic fistula, during which time there had been little if any subsidence in the size of the inflammatory mass in the pelvis, it occurred to one of us (Pemberton) that heat, applied as in the Elliott treatment, might hasten the absorption of part or all of the tumor and render the affected portion of the intestine more amenable to surgical resection. The result appeared so remarkable and immediate, at least to us, as to warrant the report of the following case.

A man, 53 years of age first registered at The Mayo Clinic, August 19 1935 complaining of backache general

From the Division of Surgery The Mayo Clinic

malaise, and pyuria. In May, 1934, he had had a severe sore throat with chills, fever, and marked cervical adenopathy. One week later, severe pain had developed over the symphysis and mild dysuria had been noted. Examination of the urine had revealed pus. There had not been any associated pain in the flanks. Since this attack the patient had not been well but it had been difficult to elicit any specific complaint. No dysuria or pain had been present. The patient had noted only a slight discomfort in the right lumbar region after he had been on his feet for some time. He had lost 20 pounds (9 kilograms). There had been no hematuria, colic, or passage of gravel. About 1 month prior to his admission to the clinic he had noticed the passage of gas from the urethra at the end of micturition but this phenomenon had disappeared, and at the time he came to the clinic, he had no urinary symptoms except the pyuria, discovered by his physician.

The family and marital histories were without significance. Alcohol was used slightly and tobacco moderately. The previous illnesses had been limited to typhoid fever and tonsillitis. Varicose veins had been treated by injection at intervals during the 3 years before he came to the clinic. He had been subject to slight constipation which had required a cathartic about once a week. There had been no urinary disturbance prior to the one already mentioned, except occasional nocturia.

Physical examination revealed a well developed and well nourished man who did not appear acutely ill. His height was 70½ inches (179 centimeters). His normal weight had been 220 pounds (99.7 kilograms) and his weight at the time of his examination at the clinic was 191 pounds (86.6 kilograms). The values for the blood pressure, expressed in millimeters of mercury were 128 for the systolic and 85 for the diastolic. The pulse rate was 74 beats per minute and the temperature was 98.4 degrees F. The skin was normal and the pupils reacted to light and accommodation. The teeth were in fair condition and the tonsils were atrophic and scarred. The abdomen was protuberant and tympanic, no masses or tenderness and no hernia were discernible. Testes were normal. Digital examination of the rectum revealed a normal prostate gland, but a moderately tender, firm mass just above it. The reflexes were normal. A few varicosities were present on both legs.

Examination of the urine did not reveal any abnormality except for pus graded 1 on a basis of 4, that is about 6 cells to a low power field. There was no growth from a culture on Endo's medium. The flocculation test for syphilis was negative. The value for the hemoglobin was 14.1 grams per 100 cubic centimeters of blood. There were 4,100,000 erythrocytes and 12,400 leucocytes per cubic millimeter of blood. The value for the blood urea was 28 milligrams per 100 cubic centimeters. A roentgenogram of the thorax was normal except for slight torsion of the aorta. A roentgenogram of the kidneys, ureters, and bladder revealed a spina bifida occulta of the last lumbar vertebra and a rounded shadow just off the transverse process of the first lumbar vertebra on the left, which probably was extra urinary. Roentgenoscopic examination of the colon disclosed an obstructing lesion of the sigmoid flexure and perforation, believed to be the result of diverticulitis.

After cystoscopy and examination of an intravenous urogram the following urologic diagnosis was made "In the dome of the bladder there is an opening 1 by 1 centimeter in diameter which is apparently of long standing as there is no evidence of any inflammatory reaction about it flocculent material and a bubble of air pass back and forth into this on pressure. Previously it was probably connected with the bowel but now is apparently closed off. There is chronic cicatricial prostatic urethritis (2) with dilated ducts and marked deformity of the prostatic urethra and the bladder.

The proctoscopic examination did not reveal any abnormality except an anal fissure. The bowel was examined for a distance of 22 centimeters above the anus.

The clinical diagnosis was diverticulitis of the sigmoid flexure and obstruction and perforation into the bladder. The patient was advised to submit to exploration to rule out malignancy and because of the possibility that the mass might be resected.

Accordingly on August 29, 1935 by using a combination of spinal and general anesthesia exploration was undertaken. The approach was by means of a left rectus incision. A tumor the size of a doubled fist was found involving the midportion of the sigmoid flexure and its mesentery. Part of this mass extended over the dome of the bladder. It seemed definitely to be a diverticulitis. An attempt was made to use the descending colon for a colostomy in the left inguinal region but this was impossible because it was so near the midline and had practically no mesentery. Accordingly another small incision was made in the midline in the epigastrium and a loop of transverse colon was brought out as a transverse colostomy.

The colon was opened on the third postoperative day and except for a very mild bronchopneumonia on the right side the patient's convalescence was uneventful. He was dismissed September 19, 1935 and advised to return in 3 months for examination and possible resection of the mass.

On January 2, 1936 the patient returned. He had gained about 10 pounds (4.5 kilograms) since his dismissal. There had been no urinary symptoms and no gas had been passed through the urethra. The results of examination were the same as they had been before and there had been little if any decrease in the size of the hard fixed mass which filled the pelvis above the prostate. Because there had been no subsidence of the mass it was thought that heat applied in the form of the Elliott treatments per rectum possibly might produce a decrease in size of the inflammatory mass and thus render the involved intestine more amenable to resection.

Accordingly on January 4, 1936 a rectal applicator was inserted high on the anterior surface of the sigmoid flexure and treatments started with a pressure of 1½ pounds and at a temperature of 127 degrees F. The treatment was continued for 30 minutes. In the course of eight treatments the temperature was gradually increased to 130 degrees F. The pressure was increased to 3 pounds and the duration of the treatment was increased to 1 hour. These factors were maintained for five treatments in all there were 13 treatments. The intervals between the treatments averaged one day. Examination after the eighth application revealed a definite subsidence of the mass and after the completion of the heat therapy the tumor was about two-thirds its original size.

The patient was sent home and advised to return in about 2 weeks for exploration and resection of the involved intestine or drainage of the abscess if necessary. On his return the tumor had diminished appreciably in size and under spinal and general anesthesia exploration was performed on February 10, 1936 through the old left rectus incision. The mass was caused by diverticulitis of the

upper portion of the sigmoid flexure a loop of which had dropped down and was adherent to the superior and posterior surface of the bladder. This adhesion was readily separated by finger dissection and the inflammatory mass which was less than half its original size was exteriorized by a Mikulicz procedure. Ten days later on February 20, 1936, under intravenous anesthesia with pentothal sodium the exteriorized portion of the bowel was removed with the cautery flush with the aponeurosis of the external oblique muscle. There was considerable inflammatory thickening of the spur between the two limbs of the bowel and it was not deemed advisable to attempt to obliterate the spur until March 16 when one clamp was applied at the site of the exteriorization and another at the site of the transverse colostomy preparatory to closing the stoma in the sigmoid flexure and that in the transverse colon.

Clamps were applied to the spurs on April 23, 1936, May 11 and May 21. The stoma in the sigmoid flexure was closed June 1, 1936 and that in the transverse colon on June 17, 1936. The patient was dismissed from the hospital on June 30 and went home with both wounds healed.

Sydney Jones, in 1839, first recognized and reported accurately the postmortem findings in a case in which colovesical fistula resulted from diverticulitis. His consideration of the pathogenesis of the lesion could not be improved on today. "Probably fecal matter had lodged at the bottom of one of the false diverticula and had produced ulceration, owing to which an abscess was formed external to the bowel, which had eventually communicated with the bladder."

According to W. J. Mayo diverticulosis was present in 57 per cent of a series of 31,838 cases in which roentgenological examination was performed at the clinic. Active diverticulitis was present in 696 cases. Most of the patients who revealed roentgenological evidence of diverticulitis were more than 40 years of age and 64 per cent of them were males. This incidence of diverticulosis is about the same as that found at necropsy on patients who belonged to the same age group, by Robertson of the clinic. In a study of 130 cases of diverticulitis H. C. Edwards determined that there were fistulas between the colon and bladder in 3 cases. Adding to these 3 cases, 16 more instances of colovesical fistula obtained from his colleagues, he observed that this complication was five times more prevalent among men than among women and that the ages of the patients ranged from 44 to 69 years, the average being 54 years. H. Lett found colovesical fistula present in 7 of 172 cases of diverticulitis. He determined that this complication was seen once in 10,000 admissions to the hospital, it is undoubtedly rare and more often is a sequel of diverticulitis than of carcinoma. He believed that the position of the uterus between bladder and sigmoid explained the comparative rarity with which these fistulas are found among women.

The patient who has a colovesical fistula usually gives a history of long standing constipation with episodes of abdominal pain which frequently are accompanied by fever. Edwards found the abdominal symptoms to precede the appearance of the fistula by 3 years and 9 months on the average. The symptoms referable to the fistula itself often occur suddenly during an attack of abdominal pain which subsides with the appearance of cloudy and bloody urine accompanied by gas or feces, or both, from the urethra. The amount of gas and feces noticed on micturition varies considerably. Dysuria, urinary frequency, and nocturia are usually complained of because of the cystitis which almost invariably is present.

The diagnosis is based on the history of episodes of abdominal pain simulating diverticulitis, the passage of gas or feces, or both, from the urethra, and the cystoscopic findings. H. Lett has well described the various cystoscopic pictures seen in cases of colovesical fistula and classified them in three groups, depending on the stage of the disease. In the first group he included the cases of early involvement with general acute cystitis and a circumscribed red edematous area usually found on the left of the bladder fundus and upper portion of the posterior wall of the bladder. The edema of the mucous membrane of the bladder may be so marked as to throw it into folds and papillomatous projections. The second group includes the fistulas of long standing in which the opening is small so that there is very little cystitis or edema and the small ulcerated region is the only finding. The third group is that in which the fistula has closed and a traction diverticulum has been produced. This is usually obvious and the position is characteristic. There may be slight congestion of the mucous membrane.

The actual demonstration of the fistula by means of the roentgenoscope and barium enema is difficult but should be possible if the opening is of sufficient size. However, in the hands of the expert, a diagnosis of diverticulitis which will explain the findings in the bladder usually is possible by this means. It rarely is possible to find the opening in the bowel by means of the sigmoidoscope but again the presence of diverticulitis may be ascertained and malignancy occasionally may be ruled out.

In spite of the trepidation with which the surgeon attempts to remedy this condition there is fair uniformity in the procedures used by those who have had a considerable experience. W. J. Mayo, Judd, David, Hunt, Abell, and Rankin all advocated preliminary colostomy before attempt-

ing to disconnect the vesicocolic fistula or to resect the mass if this proves necessary. After dissecting and suturing the fistulous tract, C. H. Mayo recommended interposing the omentum between the bladder and bowel and around the latter, which is finally sutured to the abdominal wall. It is important, as advised by Lett and Edwards, that the colostomy be of such a type and so situated as completely to sidetrack the fecal stream and put at absolute rest the affected portion of the colon. After this preliminary step, an interval of as long as one year has been recommended to allow the inflammation to subside before attempting repair or excision of the fistula. It is during this interval that the application of heat in the form of the Elliott treatment is advocated and was found to be so efficacious in the case cited. It is our belief that this interval between colostomy and repair or excision of the fistula can safely be shortened to 3 months if the patient undergoes a thorough course of heat treatments and if there is a perceptible decrease in the size of the inflammatory mass as determined by examination. If at the time of the second exploration resection is believed necessary, the Mikulicz type of exteriorization is, if applicable, the ideal procedure. The graded operation is superior because of the lower morbidity and mortality which accompanies it and because there is less danger of contamination resulting in peritonitis than when primary anastomosis of the bowel is attempted at the time of resection.

REFERENCES

1. ABELL, IRVIN. The diagnosis and treatment of diverticulitis and diverticulosis. *Surg., Gynec. & Obst.*, 1935, 60: 370-377.
2. DAVID, V. C. Diverticulosis and diverticulitis with particular reference to diverticula of the colon. *Surg., Gynec. & Obst.*, 1933, 56: 375-381.
3. EDWARDS, H. C. Diverticulitis: a clinical review. *Brit. M. J.*, 1934, 1: 973-977.
4. HUNT, V. C. Diverticulosis and diverticulitis of the colon. *Calif. & West. Med.*, 1934, 40: 98-107.
5. JONES SYDNEY. Communication between the sigmoid flexure and the bladder: the result of ulceration of a false diverticulum. *Tr. Path. Soc. London*, 1858-1859, 10: 131-132.
6. JUDD, E. S., and PHILLIPS, J. R. Diverticulitis. *Surg. Clin. N. America*, 1934, 14: 542-548.
7. LETT, HUGH, NITCH, C. A. R., LOCKHART MUMFERY, J. P., NORBURY, L. E. C., DUKES, CUTHBERT and MILLIGAN, E. T. C. Discussion on urinary complications of diseases of the large intestine. *Proc. Roy. Soc. Med.*, 1932, pt. 2, 25: 1811-1833.
8. MAYO, C. H. Quoted by Mayo, W. J.
9. MAYO, W. J. Diverticula of the sigmoid. *Ann. Surg.*, 1930, 92: 739-743.
10. RANKIN, F. W., and BROWN, P. W. Diverticulitis of the colon. *Surg., Gynec. & Obst.*, 1930, 50: 836-847.
11. ROBERTSON, H. E. Quoted by Mayo, W. J.

EDITORIALS

SURGERY

Gynecology and Obstetrics

FRANKLIN H. MARTIN, M.D.
Founder and Managing Editor
1903-1935

ALLEN B. KANAVEL, EDITOR

Issues

LOYAL DAVIS

SUMNER L. KOCH MICHAEL L. MAISON

DONALD C. BALFOUR *Associate Editorial Staff*

AUGUST 1937

VIEWPOINTS RELATIVE TO ABDOMINAL SURGERY GYNECOLOGY, AND OBSTETRICS

MEDICAL and surgical specialization should not signify that the qualified specialist in any field limits his knowledge and training to regions. No one realizes this better than the internist and the obstetrician. There are two types of internists—those who care for adults and those who handle children. Of course there are those, such as the neurologist, gastroenterologist and others who limit their activities to various systems and regions. These specialists cannot ignore other fields and must consider the patient as an organism in her relationship to the environment. A medical as distinguished from a surgical disorder can hardly remain localized. A condition which is amenable to surgical or operative treatment must be localized though it may have an effect on the whole organism. A gastric ulcer is a local

process and becomes at times a surgical disorder, nevertheless, it may, through digestive disturbance and bleeding, produce systemic effects.

In a similar manner the gynecologist may be confronted with a fibromyoma of the uterus which bleeds and produces a marked secondary anemia which can be corrected by removal of the exciting cause. Both the surgeon and the gynecologist are liable to focus attention upon the local condition which they are called upon to treat by mechanical methods. Neither of these specialists deals with physiological processes but with pathological conditions. This does not imply that they are necessarily unfamiliar with physiology, which is an essential part of their intellectual equipment, but it does mean that their daily routine is concerned with abnormal processes.

The obstetrician, on the other hand, constantly is confronted with the physiology of pregnancy, of labor, of the puerperium, and of lactation. The pathological state associated with these processes is present in only a minority of his patients. He therefore has a different viewpoint with reference to his patient who is a woman passing through a physiological process which affects the physiology of all her organs and any one of which may be subject to some disease process at any time.

The surgeon, the gynecologist and the obstetrician all should have a common viewpoint with reference to surgical technique. They should all know how to maintain asepsis, control hemorrhage, prevent shock, minimize trauma and repair injuries. No one can or should practice in any one of these fields without such fundamental knowledge upon which to build the practice of his art. No one should

practice abdominal surgery who does not understand the physiology, pathology, and treatment of diseases of the gastro intestinal tract. No one should practice gynecology who does not have an adequate, corresponding knowledge of the female generative organs. No physician should practice obstetrics who does not possess the special knowledge of the normal and abnormal processes associated with reproduction. It is equally true that the abdominal surgeon should know the pelvic structures and that the pelvic surgeon should have knowledge at least of the lower abdominal viscera. The obstetrician and gynecologist must be familiar with the vaginal route, which knowledge is not so essential for the abdominal surgeon.

The non-pregnant woman cannot be separated sharply into regions for division among specialties. The pregnant woman presents special problems of both general and local character during pregnancy and especially when in labor. The remote consequences of parturition lead one into the field of gynecology almost constantly, but seldom into abdominal surgery above the pelvic level. Disease of the generative organs frequently affects the reproductive function in some of its activities. These fields of specialization are closely related technically and practically, and from the standpoint of teaching. The capacity of doctors for knowledge and activity varies enormously. One man may be a better abdominal surgeon, gynecologist, and obstetrician, than another is an obstetrician, but as a rule a man works best in the field of his greatest interest, and it is difficult to be equally interested in and informed about all fields. The specialist should maintain his interest in the patient rather than in regions, he should recognize his proficiencies and his deficiencies and be guided by the best interests of the patient rather than by his own

So far as the named specialties are concerned nothing could be more conducive to the welfare of women than close co operation in actual practice among those who are skilled in their respective activities. There should be mutual recognition of the rights of patients and the abilities of other specialists. The surgeon or gynecologist or other specialist who delivers a few women annually by cesarean section is probably not equipped to pass judgment upon the desirable procedure for a woman whom he sees in consultation with a general practitioner any more than an obstetrician would be able to decide upon the preferable procedure in an obscure upper abdominal disease requiring surgical intervention.

A specialist and practitioner, recognizing his own limitations and the abilities of others, should be guided by the best interest of the patient in her treatment, seeking the advice and assistance of qualified consultants when their services can be of value to her.

FRED L. ADAIR

THE RADICAL VERSUS THE MORE CONSERVATIVE ATTITUDE IN THE TREATMENT OF BRAIN TUMORS

IN the surgical treatment of disease, the attitude of the profession has fluctuated constantly between the conservative and the extremely radical. Several factors are responsible for this, and the treatment of many surgical conditions has been affected. Discouraging results have made some radicals conservative, and some conservatives, realizing that they are not securing good results with conservative methods, have resorted to radical methods. Appendicitis, tuberculous glands of the neck, carcinoma of the stomach, gastric and duodenal ulcer, and trigeminal neuralgia

are a few of the conditions in which great changes in treatment have been made within a few years

One factor that has brought about such changes is the fact that the study of series of cases in which certain methods have been used has shown that the results do not justify the continuance of these methods. A second factor is that the mortality percentage following certain radical procedures may be so great that the surgeon hesitates to continue to use the method. While this may delay progress for years, still some surgeons, even while depressed by poor results, have been so certain they were right that they have persisted and have ultimately triumphed. Billroth, for instance, in 1878 wrote to his former pupil Czerny that of 3 patients upon whom ovariectomies had been performed, 2 had died. He steadfastly continued, however, and a few years later was able to report the good results with which we are all familiar today.

The radical treatment of trigeminal neuralgia, which Hartley and Krause recommended and which gave permanent cure, at first was greeted with great enthusiasm. This enthusiasm rapidly waned, however, because of the prohibitive mortality in the hands of the general surgeon. Twenty years ago the mortality rate given in Keene's *Surgery* was well over 10 per cent. But the patients suffering from *tic douloureux* clamored for permanent relief, and it was through the persistent efforts of Cushing, Frazier, and others, that the operation of section of the posterior root of the gasserian ganglion was put on a new plane. What at first had been a most formidable undertaking has now become a safe procedure, and the mortality rate is extremely low, less than 1 per cent.

At the present time, the neurological surgeon is facing a similar difficulty in another field—that of the surgical treatment of tumors

of the brain. How shall such tumors be treated? Before the days of ventriculography, when comparatively few tumors were exposed at operation, the question did not arise. But today, when over 97 per cent of all tumors are exposed at operation, the proper procedure is a problem which each surgeon must face.

Operations to remove tumors of the brain are operations of necessity, not of election—the only way at present to rid a patient of a brain tumor is to remove it, either by surgical excision or possibly by destroying it with radiation by means of radium or deep roentgen ray therapy.

In dealing with brain tumors a number of questions arise that need not be considered in tumors elsewhere in the body. The removal of a brain tumor, even a benign one such as a meningioma, may leave a patient with a permanent disability. After removal of a tumor of the occipital lobe, the patient may be left with an homonymous hemianopsia. When a tumor involving the precentral gyrus is removed, the patient may have a permanent hemiplegia or certainly a hemiparesis. Such disabilities do not follow removal of tumors in other parts of the body. The possibility that such disabilities may occur is an added factor that must be weighed before a decision is reached to remove a brain tumor. It should be kept in mind too that such disabilities may occur irrespective of the type of tumor—they may follow removal of a benign meningioma or of either a malignant or benign glioma.

Gliomas may be divided into three general groups:

1. The well demarcated tumor, even though not encapsulated. In this group belong the astrocytomas, the ependymomas, and the oligodendrogliomas, the three types of slowly growing gliomas which, I think, we have a right to look upon as benign tumors. Some of these tumors may be partially calcified.

2 The radiosensitive tumors—the medulloblastomas

3 The spongioblastic type These tumors show a great tendency to recur and must be considered malignant

There is no disagreement today about the treatment of a benign tumor, even if we know its removal will leave the patient with some disability, such as has been mentioned. In the past few years, however, a curious tendency has developed in regard to the treatment of the spongioblastic tumors—now spoken of as glioblastomas—and the radio-active tumors—the medulloblastomas

It is a fact well recognized by the neurological surgeon that the exposure of a tumor at operation without removing it, only a decompression being done, greatly increases the immediate mortality of operation. Consequently, when a tumor, even a glioblastoma, is exposed at operation as complete removal as possible should be undertaken to afford the patient temporary relief. The surgeon who believes in the radical procedure will leave a decompression as a safety valve, and then if the tumor recurs he may make another attempt to relieve the patient and try again to eradicate the disease. The conservative surgeon, however, has claimed that no glioblastoma can be cured and therefore that only one operation should be undertaken, that it is better not to do a decompression so that when the tumor recurs the patient will die promptly, thus sparing him a long period of disability and the family much anguish and expense. Others suggest that a certain group of tumors, the medulloblastomas which are radiosensitive, should not be operated upon at all, and without histological confirmation should be treated with deep roentgen-ray therapy, which is acknowledged to be only a palliative procedure.

I cannot subscribe to these points of view, for to do so would be to assume that we have

gone as far as we can in the surgical treatment of these conditions, it is an acknowledgment of defeat. To my mind, it is an extension of the euthanasia idea which, though it may be justified in conditions that are definitely hopeless, has no place in any condition in which there are possibilities, even though remote, of curing the patient. Surgical progress would have ceased long ago had this defeatist attitude been followed.

It was my privilege 30 years ago to hear Victor Horsley express himself on this subject. He was asked to see a patient with a pituitary tumor. Up to that time he had operated in very few such cases and had never cured one. He announced that he would operate upon the patient. His colleague remarked, "But the patient will die." His answer was, "Yes, probably, but if I don't undertake it, those who will come after me will not learn to do these cases successfully." This, I take it, is the attitude of the pioneer and the conqueror who is never willing to accept defeat, but keeps on striving for greater things.

Until some new method of treatment is devised, patients with brain tumors can be cured only by having the tumor removed surgically. A few cases of glioblastoma have had no recurrence and are living years later, some patients who had medulloblastomas removed are living and well at the end of 7 to 8 years. The ultimate result in eighth nerve tumors, acoustic neuromas, is better if the tumor is radically removed, even though at present the immediate mortality is greater than when it is incompletely removed by the intracapsular method. This simply means that we must perfect our technique as Billroth perfected his through trial and error to final success.

Progress seems to demand that the radical removal of tumors of the brain is what we should strive for, even though it may not be possible to apply this principle in every in-

stance If only one patient in perhaps a hundred of these cases can be or has been cured, the possibility that newer or more radical methods may accomplish more must be kept in mind Following this line of reasoning, in addition to radical extirpations, we have in the past year been giving very large doses of x ray directly into the operative wound

Those who are doing surgical work which is in the nature of pioneer work must carefully weigh the sociological and economic needs against the medical needs Like Victor Horsley they must weigh the present day results with the good to be derived by future generations But if they allow the economic and social needs of the patient to influence them too greatly, the desire to press on along a path which at first may not yield results may be set aside The pioneer spirit, the all consuming wish to make advances and improve results, has characterized the thoughtful, progressive surgeon at all times

ERNEST SACHS

WORKS OF ART IN MEDICINE AND SURGERY

IT has been suggested by Alexander Woollcott that the Mellon art treasures should not be housed in a formidable museum in Washington where only a few of the fortunate people able to travel can see and enjoy them, but that the pictures be sent on tour, so to speak It would be his idea to arrange for

these valuable and beautiful works of art to be on view in the various cities of the United States in turn By so doing it would be possible for the largest number of people to see and enjoy them In other words, Woollcott would not entomb them in a pretentious mausoleum of art in Washington whence one must travel to enjoy them

The editors of SURGERY, GYNECOLOGY AND OBSTETRICS have realized that the fine engravings of the portraits of historical figures in medicine are not available even in one museum to all of the doctors who are interested and would enjoy seeing them It seemed practical and worth while to reproduce those masterpieces in this journal from time to time in such a manner that they might be kept and preserved permanently by our readers

In January, the original engraving by W Holl of Ambroise Paré was reproduced In April, the classic painting by E Hamman of Andreas Vesalius was reproduced from the original lithograph by A Moulleron In this issue, the portrait of John Hunter is reproduced from an engraving by William Sharp of the painting by Sir Joshua Reynolds All are famous among medical bibliophiles and the collectors of art relating to medicine We trust that our readers will be interested in preserving these reproductions as representing a part of the cultural side of surgery There are many other artistic and historical masterpieces which the Editors hope to make available from time to time



CLEMENT CLEVELAND
1843-1934

MASTER SURGEONS OF AMERICA

CLEMENT CLEVELAND

ON April 16, 1934, Dr. Clement Cleveland died at his winter home in Florida, having just entered his ninety-first year. Few men have been so vitally active for so long a time, so mentally alert, so interested in life, as he. When the writer of this brief sketch first knew him, forty-three years ago, he looked the athlete that he was—ready for any encounter. Since then, an intimate and uninterrupted association with him showed a mental alertness and development which far outstripped his physical powers. His interest in the practice of his profession was intense, and there was no sacrifice of time or money too great for him to make. His sympathy for rich or poor was unbounded, and its practical application was never wanting. His geniality won him devoted and constant friends and his spirit in the sick room brought comfort, even when hope of life was lost. His personal characteristics were striking and his many scientific attainments of high order.

Dr. Cleveland was born in Baltimore, Maryland, on September 29, 1843, of an old English and New England ancestry. He graduated from Harvard in 1867 with the degree of Bachelor of Arts. He continued his studies at Harvard for his Master's degree and at the College of Physicians and Surgeons for his Medical degree, obtaining the former in 1870 and the latter in 1871. His active medical career began as an interne at the New York City Hospital, from which he received his diploma in 1871. He then became an interne at the Woman's Hospital in the State of New York, receiving his diploma in 1872. From 1874 to 1877, he served the City Hospital as attending surgeon, and from 1882 to 1915 he served as attending surgeon to the Woman's Hospital, followed by 3 years as surgical director. His services were continued in this institution as consulting and emeritus surgeon until his death. He was one of the founders of the Memorial Hospital, known then as the Cancer Hospital, where he served as surgeon for 3 years and as consulting surgeon until his death. It was at this institution that he first became interested in the study of malignant diseases peculiar to women—an interest which led him, with others, to organize the Society for the Control of Cancer.

Dr. Cleveland's scholastic education was at an institution which offered every opportunity to a student that could then be had in this country. He came in contact and was greatly influenced by such men as Wolcott Gibbs, Charles W. Eliot, Andrew Preston Peabody, Oliver Wendell Holmes, and in New York,

where he took his medical degree and early training by Drs Francis, Barker, Sims, Thomas, Peasley, and others of great fame. His medical classmates and companions, Kimcutt, Bull, and Beverly Robinson, who became as he did, outstanding in their special fields remained his devoted friends throughout their lives.

His apprenticeship at the Woman's Hospital was during the pioneer days of gynecology. There he had the opportunity of seeing the work and of working with the foremost men of that day in this special field. Sixty-three and 24 years before, Ephraim McDowell and Marion Sims, respectively, had blazed the way in major abdominal and plastic surgery. But the full results of their knowledge and skill in allaying the fears of suffering and afflicted women were not realized until the coming of anesthesia and antiseptics. Thomas A. Emmett, Gaillard Thomas, and Edmund R. Peasley followed, adding their surgical techniques and dexterity as priceless contributions to the advancement of gynecology.

It was in this atmosphere charged with attainments, disappointments, and great hopes--on the very threshold of Lister's great work--that Clement Cleveland was privileged to begin his active surgical career. And of those who started with him, few if any, outstripped him in the race.

Interested in everything pertaining to life and its preservation, and backed by a laudable ambition to vie with his colleagues in service to humanity, he fought his way in his chosen field to an honorable fame. To evaluate him, we must consider his work from the standpoint of scientific mechanics and from the standpoint of art or individual dexterity, for the time in which he was most active was that of the development of the mechanics of surgery. He became acquainted with bacteriology and pathology chiefly in a practical way, and applied intelligently the knowledge he acquired. His original work in the field of mechanical inventions was recognized in his day, as, for example, his self-retaining speculum, his ligature carrier and adjustable laparotomy table, for which he was awarded a gold medal by the French Government in appreciation of its value in securing the Trendelenburg position. As time passed on, these with other inventions were superseded, but they served as stepping stones in the great advance of surgery.

By the recognition of his valuable literary contributions to surgery, by the recognition of his inventive genius in the mechanics of surgery, by the recognition of the many improvements in surgical technique and for the art in which he executed his work, he was honored many times and in many ways. Among the most conspicuous honors he received, were the presidencies of the New York Obstetrical Society and of the American Gynecological Society, the vice presidency of the Society for the Control of Cancer, a governorship in the American College of Surgeons and appointments of high trust in noted hospitals in the City of New York.

Dr Cleveland's social life was that of one surrounded by devoted friends. His acquaintance was extensive and his affiliations with social clubs, notable. He was one of the founders of the Harvard Club of New York City, one of the early members of the University Club, and a member of the Century Club. From these sources he drew many of his early friendships. But as time moved on, Death reaped his harvests, leaving him a lone sentinel until he too fell.

DOUGAL BISSELL

Received Feb 17 1787.

Please to deliver the bearer one gallon
rum, two pounds candles & four pounds of
brown sugar for a wounded prisoner

W. Eustis Surgeon

Major Ruggles or
Major Prince

Received in Account the Bearer One
Gallon Rum Two pounds Candles & four pounds fish oil

Surgeon General's
order for a command
Thomas Feb 17
1787

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

IN *Bright's Disease and Arterial Hypertension*—a well bound and well printed volume of 352 pages—the author has tried to correlate and clarify “the various opinions experienced in the enormous literature on the subject.” Dr Stone has been keeping notes on the course and progress of patients with Bright's disease for 20 years and he presents the autopsy reports on 140 cases after a general review and discussion of the literature. The author comments that one of the main reasons why divisions of renal disease into “parenchymatous” and “interstitial” groups “endured so much longer than the terminology merited was because of its simplicity. In the study of patients with Bright's disease, physicians are in many cases ignorant of the etiological sequences but are relatively secure in their conceptions based upon long observation of the clinical course of the disease.” The author then groups the problem into (1) Acute Bright's disease—hemorrhagic and degenerative (2) Chronic Bright's disease—arteriosclerotic with primary hypertension, hemorrhagic with secondary hypertension, and degenerative without hypertension. The reviews of the physiology of kidney function, water balance, edema, acidosis, and uremia are especially well done. The best of the late work has been drawn upon in an attempt to develop the subject.

The second half of the book lacks some of the force of the first half and Dr Stone's discussion brings out great gaps in our understanding of Bright's disease, the reader is impressed with the great need of further work even though great progress has been made in the past 10 years. This volume should be of definite help to the majority of physicians who treat Bright's disease.

M HERBERT BARKER

IN *ASMUCH* as the last edition of Keyes' *Urology* appeared in 1928, many improvements have occurred in the diagnosis and treatment of genito-urinary disease. The new edition¹ has been entirely rewritten to embrace the changed concepts of the character of disease, modern diagnosis and therapy, namely intravenous urography, prostatic resection, calculogenesis, tuberculosis, tumors, and irradiation therapy. The number of illustrations has been doubled. The book largely represents the senior author's experience, while the comments on

pathology, irradiology, endocrinology, and tumors are almost exclusively the junior author's.

On controversial topics, the student is referred to the discussions of various international and national societies.

The table of contents has been amplified and rearranged from its original 2½ pages to 11½ pages. This is a much needed improvement. The index of necessity has been enlarged, and the many new words and expressions indicate the number of changes in urology in a scant 10 years.

The term “achalasia” has almost completely replaced the word “sclerosis” in reference to the vesical neck. Avitaminosis, hyperparathyroidism, prolan A and the rôle of other endocrine substances are new subjects in this volume. “Atony of the bladder,” neglected for some time, is again included.

Formerly it was stated categorically that the urinary tract was entirely aseptic now—emphatically *no*. It is eminently infectable. The introduction of less harmful contrast media in pyelography has removed the former dangers of bilateral simultaneous pyelograms. The cystometer is believed a misleading weapon except in expert hands.

Heat therapy in the treatment of gonorrhea is fully discussed. “Fever therapy, though by no means always successful, is specific and requires no supporting systemic or local treatment of the gonorrhea.” The conclusions are “In the present state of our knowledge, heat therapy is too uncertain in its results as well as too prostrating, too dangerous, too expensive for use in any but the most unusual circumstances.”

The progress in our knowledge of the pathological physiology and diagnosis of tumors of the testicle is excellent.

In discussing transurethral prostatic resection, the hand of the senior author can be plainly seen. He discusses with his usual candor and humor the status of this popular controversial procedure. In effect, it is an operation which the average urologist will never do well. Naturally, in such a textbook, the beginner should be properly advised. Transurethral resection should be done only by the expert. The authors favor the two stage suprapubic operation and for small prostates, resection by the best method learned at a successful clinic. The application of resection for carcinoma of the prostate is mentioned but not stressed.

The reviewer and his colleagues have used Keyes' *Urology* as a standard textbook in teaching medical students for many years. We find the new edition by Keyes and Ferguson vastly superior in every

¹BRIGHT'S DISEASE AND ARTERIAL HYPERTENSION. By Willard J. Stone. B.Sc. M.D. F.A.C.P. Philadelphia and London. W. B. Saunders Co. 1938.

²UROLOGY. By Edward L. Keyes. Ph.D. F.A.C.S. F.R.C.S. (Hon. Eng.) and Russell S. Ferguson. A.B. M.D. 6th ed. New York and London. D. Appleton-Century Co. 1936.

Proffected Feb 17 1787.

See Please to deliver the bearer one gallon
rum, two pounds candle, & four pounds of
brown sugar for a wounded prisoner

W. Eustis Surgeon

Sgt Ruggles or
Sgt Prince

Received on Account the Bearer One
Gallon Rum Two pounds Candles & four pounds
brown sugar

Surgeon General's
order for a warrant
Proffected Feb 17
1787

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York, *President*

FREDERIC A. BESLEY, Waukegan, *President-Elect*

VERNON C. DAVID, *Chairman*, MICHAEL L. MASON, *Secretary*, *Committee on Arrangements*

PRELIMINARY PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

THE surgeons of Chicago, under the leadership of a representative committee, will provide a program of clinics and demonstrations for the twenty-seventh annual Clinical Congress of the American College of Surgeons in Chicago, October 25-29, that will present a complete showing of the clinical activities in all departments of surgery in this great medical center.

A preliminary schedule of the operative clinics and demonstrations, as prepared by the committee, appears in the following pages. Published in tentative form at this time the clinical program will be revised and amplified during the months preceding the Congress. It will be noted that clinics are being arranged for the afternoon of Monday, October 25, and for the mornings and afternoons of each of the four following days.

In addition to an ample and well arranged schedule of operative clinics that will demonstrate the technique of a wide variety of surgical procedures, the committee is arranging a series of demonstration clinics at the medical schools and in the larger hospitals to present the work being done in many special fields, including neurosurgery, traumatic surgery, thoracic surgery, plastic surgery, fractures, cancer, orthopedics, gynecology and obstetrics, genito-urinary surgery, experimental surgery, physical therapy, roentgenology, etc.

The committee is assured of the hearty co-operation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

So that the visiting surgeon may be assured of an opportunity to devote his time continuously, if he wishes, to clinics dealing particularly with those special subjects in which he is most interested, the committee has undertaken to correlate the programs of the participating institutions planning to arrange so that fracture clinics or

cancer clinics, for example, will be available each morning and afternoon during the five days of the Congress.

An extensive schedule of operative clinics and demonstrations at the hospitals and schools is being prepared by the subcommittee on ophthalmology and otolaryngology. In addition programs are being prepared for two evening sessions at the Stevens Hotel at which visiting ophthalmologists and otolaryngologists will present and discuss papers of interest to those who specialize in these particular fields.

As they so faithfully depict clinical features of major interest to surgeons, the showing of surgical motion picture films will be continued at this year's session with an enlarged program of both sound and silent pictures to be exhibited daily at headquarters.

EVENING SCIENTIFIC MEETINGS

Programs for a series of evening sessions are being prepared by the Executive Committee of the Board of Regents. A preliminary outline of these programs will be found on a following page.

At the opening session, the presidential meeting and the convocation, in the ballroom of the Stevens Hotel on Monday evening, the address of welcome will be given by Dr. Vernon C. David, chairman of the committee on arrangements, following which a number of distinguished foreign guests will be introduced.

Dr. Eugene H. Pool, of New York, retiring president, will deliver the presidential address, followed by the inauguration of the new officers—Dr. Frederic A. Besley, of Waukegan, president, Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schinbein, of Vancouver, vice-presidents. At this session the 1937 class of initiates will be received into fellowship in the College. The annual college oration on surgery will be

delivered by J P Lockhart Mummery, M B, B Ch, F R C S, of London, England.

At sessions on Tuesday, Wednesday and Thursday evenings, addresses on surgical subjects of special importance will be presented by outstanding surgeons of the United States and Canada. A preliminary outline of these programs will be found on a succeeding page

AFTER-NOON SESSIONS

A cancer symposium on Tuesday afternoon, under the auspices of the Committee on the Treatment of Malignant Diseases will deal not so much with organization and administrative problems as with scientific and clinical phases of the cancer problem. Figures on five year cures of cancer being compiled by the Department of Clinical Research from statistics furnished by surgeons, pathologists and radiologists as individuals or as members of hospitals and clinics, will be presented at this conference. These, added to the 24,440 five year cures reported by the College in 1934 should provide a basis for increasing hopefulness of cancer control on the part of the public as well as of the surgeon.

The conference on graduate training for surgery to be held at 2 o'clock on Wednesday the program for which appears on a succeeding page, will be of interest to all Fellows of the College since it is one related to the requirements for fellowship. A need for consideration of the various aspects of this subject, to be participated in by prominent surgeons and representatives of other interested organizations, has long been felt. The field staff of the College has for six years been collecting and recording information on the opportunities for graduate training provided in hospitals particularly the larger ones, and this data together with findings from a 1937 survey of hospitals made by a special field representative will be reported. In a panel discussion there will be presented the viewpoints of the surgeons in the teaching hospital, the large non teaching hospital and the rural community hospital on graduate training. The findings and viewpoints of the American Medical Association, the American Surgical Association, the American Board of Surgery and others will be presented and discussed with a view to correlating all available information and experience on the subject of the opportunities now open and those which should be provided for the graduate student.

A symposium on obstetrics and gynecology is also scheduled for Wednesday afternoon. Papers of interest to the general surgeon as well as to the specialist in these fields will be presented by well

known authorities. Significant of what some surgeons today believe is a noticeable trend is the subject of the first paper, "Conservatism in Obstetrics."

Thursday afternoon will be devoted to a conference on industrial medicine and traumatic surgery. Subjects discussed will be of special interest to surgeons who are in the field of industrial medical service, but also come within the scope of general surgery, since the injuries suffered by the workman are often the same as or similar to those experienced by the autoist, pedestrian, or mere onlooker in this mechanical age. The appalling number, variety and severity of injuries, which almost any surgeon is called upon to treat, demand increasing attention to development of better methods and techniques. Results of the year's surveys will be reported by the Committee on Industrial Medicine and Traumatic Surgery under whose auspices this symposium will be held.

Surgeons in industry as well as those in general practice will be interested in the Friday afternoon program to be presented by the Committee on Fractures. Newly developed methods of dealing with fractures and their results, will be described by surgeons who have had wide experience with this type of injury.

Further exposition of the various phases and subjects of industrial medicine and traumatic surgery, cancer and fractures will be given in clinics and in demonstrations in various Chicago hospitals during the Congress. The scientific exhibits at headquarters will also include many items appertaining to these subjects.

HOSPITAL CONFERENCE

The twentieth annual hospital standardization conference of the College (see program in the following pages) will consist of morning and afternoon sessions from Monday at 10:00 a.m., to Wednesday noon at the Stevens Hotel including a joint session with the Chicago Hospital Association and the Chicago Hospital Council on Tuesday evening, demonstrations in various Chicago hospitals on Wednesday afternoon, sessions Thursday morning and afternoon at the headquarters hotel, and inspection trips to Chicago hospitals on Friday.

Dr Eugene H. Pool of New York, president of the College will address the opening session. Dr George Crile, of Cleveland chairman of the Board of Regents, will present the report of the 1937 survey of hospitals and the official announcement of the approved list. There will also be presented at this session addresses dealing with the obligations of the hospital consideration of personality

and psychology factors, selection of hospital personnel, and effects of hospital insurance plans

"The Medical Staff Conference" will furnish the general theme for the Monday afternoon session. Following a discussion of the subject in its various aspects the medical staff of the Ravenswood Hospital of Chicago will stage a demonstration of a model conference.

Addresses at the Tuesday morning session will be on the general theme of the clinical departments of the hospital, and at the afternoon session on the management of hospital personnel.

"Public Relations" will be the general theme of the Tuesday evening joint session, at which Charles H. Schweppe, president of the Chicago Hospital Council, will preside. The subject will be discussed from the viewpoints of the press, the hospital administrator, the hospital trustee, and the member of the medical staff. Methods of raising funds will be considered. The importance of winning and keeping community good will will be stressed.

The Association of Record Librarians of North America will meet in joint session with the conference on Wednesday morning. Following a discussion of methods of record keeping and the value of complete medical records, a sketch, "The Medical Record Librarian's Dream Comes True," will be presented by the Medical Record Librarians of Chicago. Through this dramatization it will be shown how an interested medical staff can facilitate and make more useful to themselves, their patients, and the public, the work of the medical record librarian.

Sixteen Chicago hospitals and the University of Chicago Clinics will co-operate with the conference by providing on Wednesday afternoon demonstrations of many phases of hospital administration and operation. Delegates may at the time they register make a selection of the demonstrations they wish to attend.

Problems of hospital administration and standardization will be discussed in a round table conference and in addresses at the Thursday morning and afternoon sessions.

Friday will be devoted to visits to hospitals in Chicago and vicinity. Help in selecting these will be given delegates at headquarters for hospital registration and information.

HEADQUARTERS AND TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Stevens Hotel where the grand ballroom with its large foyers and other meeting rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments, x-ray apparatus, operating room lights, hospital apparatus and supplies of all kinds, ligatures, dressings, pharmaceuticals and publishers of medical books will be represented.

ADVANCE REGISTRATION

The hospitals and medical schools of Chicago afford accommodations for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be definitely limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories of the hospitals and medical schools to determine their capacity for visitors. Therefore, those surgeons who wish to attend the Congress should register in advance.

A registration fee of \$5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card, which is non-transferable, must be presented in order to secure clinic tickets and admission to the evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, the number of tickets issued for any clinic being limited to the capacity of the room in which that clinic is given. This plan provides an efficient means for the distribution of the visiting surgeons among the several clinics and insures against overcrowding.

RAILWAY RATES

Surgeons living in the western and southwestern states and the western portion of the southeastern states who plan to attend the Clinical Congress in Chicago may purchase round trip tickets to Chicago with a 30-day return limit on the basis of two cents per mile in each direction for transportation in Pullman cars not including the Pullman charge. From certain points in the south Atlantic coast states (southeastern territory) round trip tickets with a 15-day return limit will be sold on the basis of two cents per mile in each direction.

to Central Passenger Association gateways, plus three cents per mile in each direction from such gateways to Chicago. Round trip tickets at low rates will be available from points in the Pacific coast states.

In the territory east of Chicago, north of the Ohio and Potomac rivers including the north Atlantic and New England states and eastern provinces of Canada the regular rate of three cents per mile in Pullmans and two cents per mile in coaches will be in effect.

Complete information as to rates, routes and stopover privileges may be obtained from local ticket offices.

CHICAGO HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Stevens, there are several first class hotels within

short walking distance of headquarters providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee:

	Minimum Rate	
	Single	Double
Auditorium 430 S. Michigan Ave.	\$2.50	\$4.00
Bismarck 171 W. Randolph St.	3.50	5.00
Blackstone Michigan Ave. at 14th St.	4.00	6.00
Congress 500 S. Michigan Ave.	3.00	5.00
Drake Michigan and Lake Shore Drive	4.00	6.00
Great Northern 237 S. Dearborn St.	2.50	4.00
Harrison 57 E. Harrison St.	4.50	5.50
Knickerbocker 163 E. Walton Pl.	3.00	5.00
LaSalle 10 N. LaSalle St.	3.00	4.50
Morrison 19 W. Madison St.	3.00	4.00
Palmer House 15 E. Monroe St.	3.50	5.00
Sherman 106 W. Randolph St.	2.50	4.00
Stevens 730 S. Michigan Ave.	3.00	4.50

PROGRAMS FOR AFTERNOON SESSIONS

CONFERENCE ON GRADUATE TRAINING FOR SURGERY

Wednesday, 2:00 P.M.

FREDERICK A. BESLEY, M.D., Waukegan, Ill., President, American College of Surgeons, presiding.
Opening Remarks: GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents, American College of Surgeons.

Purpose of Conference: MALCOLM T. MACEACHERN, M.D., Chicago, Associate Director, American College of Surgeons.

Graduate Training for Surgery: ALTON OCHSNER, M.D., New Orleans.

Findings from the 1917 Survey of Hospitals by the American College of Surgeons: MELVILLE H. MANSON, M.D., Minneapolis, Special Field Representative.

Panel Discussion from the following viewpoints:

The Surgeon in the Teaching Hospital: DALLAS B. PHEMISTER, M.D., Chicago.

The Surgeon in the Large Non-Teaching Hospital: DONALD GUTHRIE, M.D., Sayre, Pa.

The Surgeon in the Rural Community Hospital: HOWARD L. SNYDER, M.D., Winfield, Kan.

The American Surgical Association: EUGENE H. POOL, M.D., New York.

The American Board of Surgery: EVARTS A. GRAHAM, M.D., St. Louis.

The American Medical Association: FRED W. RANKIN, M.D., Lexington, Ky.

Essentials in Graduate Training for Surgery: LOUIS B. WILSON, M.D., Rochester, Minn.

Discussion: Otolaryngology: PERRY G. GOLDSMITH, M.D., Toronto; Urology: FRANK HENMAN, M.D., San Francisco; Gynecology and Obstetrics: ARTHUR H. CURTIS, M.D., Chicago.

OBSTETRICAL AND GYNECOLOGICAL CONFERENCE

Wednesday, 2:00 P.M.

FRANK W. LAMB, M.D., San Francisco, Vice President, American College of Surgeons, presiding.
Conservatism in Obstetrics: GEORGE W. KOENIG, M.D., New York.

Water Balance in Relation to Toxemias of Pregnancy: M. EDWARD DAVIS, M.D., Chicago.

Pelvic Pain—Its Significance and Treatment: ARTHUR H. CURTIS, M.D., Chicago.

Cesarean Section: JOHN R. FRASER, M.D., Montreal.

Syphilis in the Pregnant Woman: JAMES R. McCORD, M.D., Atlanta.

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Convocation—Monday, 8 00 P M —Ballroom, Stevens Hotel

Address of Welcome VERNON C DAVID, M D , Chicago, Chairman, Committee on Arrangements
 Introduction of Foreign Guests
 Address of the Retiring President EUGENE H POOL, M D , New York
 Inauguration of Officers
 Conferring of Fellowships FREDERIC A BESLEY, M D , Waukegan, Illinois
 Conferring of Honorary Fellowships The President
 Annual Oration on Surgery The Surgeon as a Biologist J P LOCKHART-MUMMERY, M B , B Ch ,
 F R C S , London

Tuesday, Wednesday and Thursday, 8 00 P M —Ballroom, Stevens Hotel

Nucleus Pulposus and Lower Back and Sciatic Pains HOWARD C NAFFZIGER, M D , San Francisco
 Symposium on Lymphedema
 The Genesis and Consequences of Lymphedema CECIL K DRINKER, M D , Boston
 Circulatory and Lymphatic Disturbances in the Abdomen WILLIS D GATCH, M D , Indianapolis
 Diverticula of the Intestine CLAUDE F DIXON, M D , Rochester, Minnesota
 Immediate or Delayed Treatment of Acute Cholecystitis (Liver Shock and Death) HENRY W CAVE,
 M D , New York
 Tuberculosis of the Kidney FRANK HINMAN, M D , San Francisco
 Physiological and Pathological Changes in the Urinary Tract during Pregnancy J MASON HUNDLEY,
 Jr , M D , Baltimore
 Acute Pancreatitis IRVIN ABELL, M D , Louisville
 Fracture Oration WILLIAM O'NEILL SHERMAN, M D , Pittsburgh

Community Health Meeting—Friday, 8 00 P M —Ballroom, Stevens Hotel

Program in preparation

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday 10 00—Ballroom, Stevens Hotel

EUGENE H POOL, M D , New York, President American
 College of Surgeons, presiding
 President's Address
 Report of the 1937 Survey of Hospitals and Official
 Announcement of the Approved List GEORGE CRILE,
 M D , Cleveland, Chairman, Board of Regents American
 College of Surgeons
 The Approved Hospital and Its Obligation—Diagnosis
 and Therapy, Education, Prevention and Research
 BERT W CALDWELL, M D , Chicago
 Personality and Psychology in the Hospital G HARVEY
 AGNEW, M D , Toronto
 Criteria to be Observed When Selecting Internes and
 Residents JAMES H MEANS, M D , Boston
 The Effect Hospital Insurance Plans Are Having on
 Medical and Hospital Services C RUFUS ROREM
 Ph D , Chicago

Monday, 2 00—Ballroom, Stevens Hotel

GEORGE E WILSON, M B , Toronto Vice President
 American College of Surgeons presiding
 The Medical Staff Conference—with Panel Discussion from
 the Following Viewpoints

General Presentation of Subject HAROLD L FOSS, M D ,
 Danville, Pa
 Proper Attitude of the Medical Staff JAMES T NIX,
 M D , New Orleans
 Time, Place and Physical Essentials WILLIAM H WALSH,
 M D , Chicago
 Conduct of the Conference EDWARD L TUOHY, M D ,
 Duluth, Minn
 Criteria of a Good Medical Staff Conference FELIX P
 MILLER, M D , El Paso, Texas
 Demonstration—A model medical staff conference by the
 medical staff of Ravenswood Hospital Chicago

Tuesday, 10 00—Stevens Hotel

E WELDON YOUNG, M D , Seattle, Wash , presiding
 Clinical Departments of the Hospital, Embracing Organi-
 zation, Direction Control, Functioning
 Oral Surgery and the Dental Department in the General
 Hospital WILLIAM H G LOGAN, M D , Chicago
 Psychiatric Department in the General Hospital SAMUEL
 W HAMILTON, M D , New York
 The Physical Therapy Department in Small, Medium and
 Large General Hospitals JOHN S COULTER, M D ,
 Chicago

The Out patient Department in the General Hospital.
 CHRISTOPHER G FARNALL, M D Rochester \ \

The Obstetrical Department in the General Hospital
 OTTO H SCHWARTZ, M D St Louis.

Tuesday 2 00—Stevens Hotel

FRED G CARTER M D Cincinnati presiding
 Hospital Personnel Management—with Panel Discussion
 from Various Viewpoints
 General presentation of subject. FRANK J WALTER,
 Denver

Selection E MURIEL ANSCOMBE R.N. St Louis.
 Physical Health. HAROLD L SCAMMELL, M D Halifax
 \ S

Assignment of Duties. CLINTON F SMITH Chicago
 Working and Living Conditions JOSEPH G NORBY
 Milwaukee

Morale. MACIE \ KAPP R.N. Normal Ill
 Training and Education of Hospital Personnel GEORGE
 O HANLON M D Jersey City \ J

Tuesday 8 00 p m—Stevens Hotel

Joint Session—with Chicago Hospital Association and
 Chicago Hospital Council. CHARLES H SCHWEPPEL Chi
 cago presiding

Public Relations—with Panel Discussion from the Follow
 ing Viewpoints
 General presentation of subject. PERRY ADDLEMAN
 Chicago

The Hospital Administrator. ADA BELLE McCLEERY
 R \ Evanston Ill

The Member of the Medical Staff. FREDERIC J COTTON
 M D Boston

Fund Raising. D ALLAN CRAIG M D, Torrington Conn

Wednesday 10 00—Stevens Hotel

Joint Session—with Association of Record Librarians of
 North America. R C BLERNT M D, Madison Wis
 presiding

Developing a Medical Record Consciousness in the Hos
 pital. SISTER M PATRICIA OSB BS RRL
 Duluth Minn.

What Constitutes a Proper Appraisal of the Medical
 Record. CHARLES B PUTSTON M D Chicago and
 LILLIAN H ERICKSON RRL Milwaukee

Incomplete Medical Records—Causes and Remedies
 ALICE G KIRKLAND RRL Oakland Calif

The Pervasive Value of Good Medical Records.
 RICHARD B DAVIS M D Greensboro \ C

The Technique of Making Group Studies of Diseases
 THOMAS R PONTON M D Chicago

Sketch—The Medical Record Librarian's Dream Comes
 True Presented by the Medical Record Librarians of
 Chicago

Wednesday - 00

Demonstrations in the following Chicago hospitals
 Chicago Memorial, Children's Memorial Cook County,
 Grant, Hennrich, Michael Reese Pa-savant Memorial,
 Presbyterian Ravenswood Research and Educational,
 St. Elizabeth's St Joseph's St. Luke's St. Mary of
 Nazareth University of Chicago Clinics Wesley
 Memorial West Suburban

Thursday 10 00—Stevens Hotel

Panel Round Table Conference—Pertinent Problems Pe
 lating to Hospital Administration and Hospital Stand
 ardization. Conducted by ROBERT JOLLY Houston
 Texas and R. C BLERNT, M D Madison Wis.

Call Systems for Hospitals. JOHN CORRELL, M D Grand
 Rapids Mich.

Administrative Problems of the Small Hospital. GLADYS
 BRANDT R.N. Loganport Ind.

Nursing Service. SISTER MARY LIDWYN Chicago

Medical Social Service Standards. BABETTE JENNINGS
 Chicago

Air-Conditioning in Hospitals. PERRY W SWERN Chicago

Hospital Income. BRUCE L TWITTIN Dallas Texas.

Technical Service Standards in the Hospital. CLAUDE W
 MINGER M D, New York.

Thursday 2 00—Stevens Hotel

Standardization of Hospital Furnishings, Equipment and
 Supplies. L M ARROWSMITH, Brooklyn.

Food Service. MIRIAM C CONNELLY Baltimore

Professional Problems of the Small Hospital. MARY E.
 SKEOCH R.N. Marquette Mich.

Nursing Education. MARY M ROBERTS R.N. New York.

Out patient Department. FREDERICK MACCERDY M D
 New York

The Cancer Clinic in the General Hospital. FRANK E.
 ADAMS M D New York.

The Hospital Pharmacy. EDGAR C HAYBOW Paterson
 \ J

The Front Office of the Hospital. LEE C GAMMILL,
 Little Rock Ark.

Friday

An opportunity will be afforded the hospital delegates
 to visit Chicago hospitals. Special information pertaining
 to each institution will be available at the hospital registra
 tion and information desk.

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS GENERAL SURGERY, GYNECOLOGY AND OBSTETRICS, GENITO-URINARY SURGERY, FRACTURES AND TRAUMATIC SURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, NEUROSURGERY, THORACIC SURGERY, TUMORS AND IRRADIATION, ROENTGENOLOGY, PHYSICAL THERAPY, EXPERIMENTAL SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL

CHARLES J DRUECK, SR, GEORGE L BROOKS, OTTO SAPHIR and GEORGE LANDAU Symposium Carcinoma of the rectum, carcinoma of the colon
CHARLES E KAILLE, GEORGE L BROOKS, OTTO SAPHIR and GEORGE LANDAU Symposium Peptic ulcer

PASSAVANT MEMORIAL HOSPITAL

SUMNER L KOCH, MICHAEL L MASON and HARVEY S ALLEN Surgery of the hand Dupuytren's contracture Von Volkmann's contracture, nerve and tendon suture, burn contractures of the hand and plastic repair with skin grafts chronic tenosynovitis

ST ANTHONY DE PADUA HOSPITAL

R C DRURY Spinal anesthesia

ST BERNARD'S HOSPITAL

R J FASIO Blood transfusion, merits of accepted methods

WOMEN AND CHILDREN'S HOSPITAL

CLEMENTINE FRANKOWSKI and HELEN M KOSTKA Vari-
cose veins, treatment by injection and by ligation

Tuesday Morning

AUGUSTANA HOSPITAL

N M PERCY Operations

ALBERT MERRITT BILLINGS HOSPITAL

Clinical Demonstrations

LESTER R DRAGSTEDT and staff Clinical and experimental studies in gastric and duodenal ulcer

WALTER L PALMER, F E TEMPLETON and RUDOLF SCHINDLER X ray and gastroscopic studies of gastric ulcer under medical treatment

A BRUNSCHWIG Pancreatoduodenectomy for carcinoma of the head of the pancreas

H P JENKINS Abdominal wound disruptions and the durability of catgut sutures

CHICAGO MEMORIAL HOSPITAL

CHARLES E KAILLE Stomach surgery

CHARLES J DRUECK, SR Surgery of the colon and rectum

COOK COUNTY HOSPITAL

KARL A MEYER, R H JAFFE, M J HUBENY AARON ARKIN and RUDOLF SCHINDLER Symposium Surgery of the stomach Operations

DR GATEWOOD Children's surgery

GEORGE G DAVIS ALBERT H MONTGOMERY, JOHN HARGER, HARRY JACKSON and JOHN G FROST Operations

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S Honore Street

EVANGELICAL DEACONESS HOSPITAL

EDWARD N HEACOCK Cholecystectomy

GARFIELD PARK HOSPITAL

EDMUND FOLEY, PAUL SCHMITT, HAROLD WAIT, SAMUEL PLICE, CLAUDE WELDY and FRED DE STEFANO Symposium Gall bladder disease

HOLY CROSS HOSPITAL

V F TORCZYNSKI Cholecystectomy, appendectomy, hysterectomy

M J BADZMIEROWSKI Thyroidectomy, 5 cases, cholecystectomy

J P DYBALSki Cholecystectomy, 3 cases, nephrectomy, hysterectomy

A J MANTAS Appendectomy

JACKSON PARK HOSPITAL

G M LUCAS Clinic

W MORLEY SHERIN Gall bladder surgery
Symposium Appendicitis

A BAMBERGER Surgical aspect

R R JAMIESON Medical aspect

J J MOORE Pathological aspect

LUTHERAN DEACONESS HOSPITAL

JOHN D KOUCY, G H MAMMEN and GEORGE H SCHROEDER Operations

MERCY HOSPITAL

Dry Clinic

C F SAWYER and associates Unusual causes of intestinal obstruction, partial and complete gastrectomy

M MCGUIRE and associates Pelvic appendicitis, obstructive jaundice

MOUNT SINAI HOSPITAL

V SCHRAGER Operations

J GAULT Technique of high internal saphenous vein ligation

P KAPLAN Demonstration of tubulovaginal gastrotomy

PRESBYTERIAN HOSPITAL

KELLOGG SPEED, ALBERT H MONTGOMERY, DR GATEWOOD and associates Operations

V C DAVID, C B DAVIS and E M MILLER Dry clinics and symposia

RAVENSWOOD HOSPITAL

Dry Clinic

P J SARMA Varicose veins, ligation and obliterative treatment

R E DYER End results of gastro enterostomies, demonstration of cases

D B FORD and R F GREENING Treatment of osteomyelitis

J J MOORE Tumors of breast

D L JENKINSON X ray interpretations

GEORGE DE TARNOWSKY Exstrophy of bladder

C J GEIGER Ectopic ureter and absence of vagina cervical carcinomas
 M W FIELD Obstetric practice by general practitioner
 W F GROSVENOR Toxemia in pregnancy
 W C HAMMOND Endometriosis

MICHAEL PEESE HOSPITAL

D C STRALS Thyroid operations
 RALPH B BETTMAN and WILLIAM TAN ENBAUM Gall bladder surgery
 A A STRAUSS Gastro intestinal surgery
 JAMES PATEJDL Operations
 P SHAPIRO Operations
 Symposium Gastro intestinal diseases
 A A STRAUSS Surgical treatment of peptic ulcer
 S STRAUSS Pre and postoperative care of the ulcer patient
 JAMES PATEJDL Perforating ulcer surgical treatment
 JACOB MEYER Medical care of the ulcer patient
 Symposium Carcinoma of the rectum
 A A STRAUSS Surgical
 S STRAUSS Surgical diathermy, after care and results of surgical diathermy
 M APPEL Histiocytic variation in cancer tissue
 GUSTAV KOLISHER History of surgical diathermy
 OTTO SAPIER Pathology of the rectum following surgical diathermy

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DETAKATS Lumbar sympathectomy operation
 Symposium Neurocirculatory Diseases
 R BRUNNER The use of neosynephrine in spinal anesthesia
 WILLIAM C BECK Selection of cases for sympathectomy demonstration of sympathectomized patients evaluation of results, management of lymphedema
 F A HICK Vascular accidents associated with coronary occlusion
 H C LAETH Unusual reactions following the use of nitro glycerine
 GEZA DETAKATS Treatment of acute arterial occlusion, operability of hypertension demonstration of cases
 P J SARMA and H L MISHKIN The treatment of varicose veins and ulcers
 J T REYNOLDS Amputations in peripheral vascular disease

ST ANTHONY DE PADUA HOSPITAL

JOSEPH LABOARZDAY Operations

ST BERNARD'S HOSPITAL

J T MEYER E J MEYER and R J MEYER Thyroidectomy
 W G EPSTEIN and M MENNITE Abdominal surgery and differential diagnosis of acute abdominal adhesions

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery
 AUSTIN A HAYDEN Conservation of hearing, mastoid and sinus surgery
 ARCHIBALD HOVNE Control of contagion in surgical diseases
 WILLIAM H G LOGAN Oral surgery
 FRANKLIN B McCARTY Gall bladder surgery
 CHARLES M McKENNA Undescended testicle
 HUGH McKENNA Fractures Conservative surgery in diabetic gangrene
 FRANK THEIS Peripheral circulatory diseases
 Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES pathologist and WILLIAM L ANSPACH radiologist

ST MARY OF NAZARETH HOSPITAL

GEORGE MUELLER Regional diets

VETERANS ADMINISTRATION FACILITY

PAUL F BROWN Operations

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R MEYER General surgery and fractures

WESLEY MEMORIAL HOSPITAL

F W McNEALY, EMORY STRAUSS and F L HUSSEY Gastric surgery

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

BENNETT R PARKER Thyroid surgery

COOK COUNTY HOSPITAL

EDWARD J LEWIS Operations

HOLY CROSS HOSPITAL

M J BADZIEJOWSKI Pre and post-operative treatment of thyroid disease

JACOBSON PARK HOSPITAL

HARRY E L TYM Operations

MERCY HOSPITAL

C L MARTIN Symposium Rectal neoplasms and inflammations

J E KELLEY The hernia problem

PASSAVANT MEMORIAL HOSPITAL

J R BUCHBINDER A C IVY and ARTHUR BYFIELD Symposium on the biliary tract

MICHAEL REESE HOSPITAL

Dry Clinic

NATHAN CROWN The use and abuse of the injection treatment of hernia suitable and unsuitable cases method
 LEO ZIMMERMAN Surgical treatment of direct inguinal hernia
 RUDOLF SCHINDLER The use of the gastroscope and its value to the surgeon
 SAMUEL GOLDBERG Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections
 JAMES PATEJDL Congenital duodenal obstruction in newborn duodenal diverticuli causing clinical symptoms

Dry Clinic

LEO ZIMMERMAN Diseases of veins
 PHILIP SHAPIRO Recent advances in the treatment of varicose veins
 BERNARD PORTIS Embolism of the peripheral arteries
 SAMUEL PERLOW Surgical measures used in the treatment of peripheral circulatory disturbances, differentiation between arterial and arteriolar spasticity as an aid in the selection of cases for sympathetic ganglionectomy

ST LUKE'S HOSPITAL

GEZA DETAKATS GEORGE SOUTHAM GEORGE K FENN CARL JOHNSON and RICHARD CAPPY Surgery of cardiovascular diseases

ST MARY OF NAZARETH HOSPITAL

P DORETTI and T PLANT Abdominal operative clinic

VETERANS ADMINISTRATION FACILITY

PAUL F BROWN Symposium Stomach surgery

WOMEN AND CHILDREN'S HOSPITAL

Management of Diseases Complicating Surgery

CAROLYN MACDONALD Syphilis
 ROSE MENENDIAN Endocrine disorders
 RUTH RENTER DARROW Diabetes

Wednesday Morning

AUGUSTANA HOSPITAL

A. T. LUNDGREN, EARL GARSIDE, R. J. E. ODEY and
 J. W. NIZUM Operations

CHICAGO MEMORIAL HOSPITAL

PETER S. CLARK, VANCE RAWSON, GEORGE LANDAU and
 OTTO SAPHIR Gall bladder symposium
 LEO W. ZIMMERMAN and RICHARD E. HELLER Fundamen-
 tal problems in the surgical treatment of inguinal hernia,
 modern management of varicose veins

CHILDREN'S MEMORIAL HOSPITAL

A. H. MONTGOMERY, J. IRELAND, J. GRAHAM, W. POTTS,
 A. DIGGS and J. MUSSIL Operations and demonstration
 of cases

COLUMBUS HOSPITAL

D. A. ORTH and E. NORA Bone and joint tuberculosis,
 peritonitis, Roether treatment

COOK COUNTY HOSPITAL

RAYMOND W. MCNEALY, MANUEL LICHTENSTEIN, FRED
 ERICK TICE, RICHARD H. JAFFE and M. J. HUBENY
 Symposium Diseases of the gall bladder
 RAYMOND W. MCNEALY, VICTOR SCHRAGER, GEORGE L.
 APPELBACH, ROGEE T. VAUGHAN and MARSHALL
 DAVISON Operations

Members of the surgical staff will give demonstrations
 in surgical technique upon cadavers and dogs in the labora-
 tories of the Graduate School of Medicine 427 S. Honore
 Street

EVANSTON HOSPITAL

Symposium Colon Surgery

L. D. SNORF Diagnosis
 E. R. CROWDER Roentgenology
 E. L. BENJAMIN Pathology
 FREDERICK CHRISTOPHER Surgery
 W. R. PARKES Prognosis in malignancy
 Dry Clinic

MARCUS HOBART Operative treatment of low back pain
 JAMES GRIER Common bile duct obstructions
 W. K. JENNINGS Prevention of recurrence in femoral
 hernia operations

HOLY CROSS HOSPITAL

CHARLES M. MCKENNA Cholecystectomy, hemorrhaphy
 F. DYBALSKI Open reduction of fracture of femur
 F. KRAFT Hysterectomy, perineorrhaphy
 F. SALETTA Hysterectomy, perineorrhaphy, operation for
 shortening round ligament
 M. STRIKOL Appendectomy, hemorrhaphy

JACKSON PARK HOSPITAL

ARRIE BAMBERGER Pre and postoperative treatment of
 surgical cases
 C. C. CLARK and H. HOYT COX Operations

LUTHERAN DEACONESS HOSPITAL

GEORGE O. SOLEM. Surgical indications in peptic ulcer

MOTHER CABRINI HOSPITAL

EUGENE J. CHESROW and ALBERT J. CHESROW Opera-
 tions
 E. P. OLIVIERI and N. V. EMANUELE Demonstration
 clinic

MOUNT SINAI HOSPITAL

E. I. GREENE Anaerobic hemolytic streptococcus infec-
 tion (Meleney's disease)
 JACOB M. MORA Thyroidectomy in the aged
 D. WILLIS Removal of foreign (metallic) bodies from
 tissues with aid of a new instrument
 J. M. GREENE Acute intestinal obstruction
 I. TRACE Postoperative pulmonary complications with
 special reference to massive pulmonary collapse
 M. L. ARLIN The surgical diabetic
 L. EDWIN and N. I. FOX Medicosurgical discussion
 L. FELDMAN Streptococic bacteremia precipitated by
 surgical procedures

MUNICIPAL TUBERCULOSIS SANITARIUM

CLEMENT L. MARTIN Anorectal tuberculosis
 MAX THOREK Surgery in tuberculous patients

POSTGRADUATE HOSPITAL

EMIL RIES Episcro iliac lipomas with backache

PPESBETRIAN HOSPITAL

V. C. DAVID, KELLOGG SPEED, C. B. DAVIS, DR. GATE-
 WOOD, E. M. MILLER, A. H. MONTGOMERY and asso-
 ciates Operations

MICHAEL REESE HOSPITAL

M. L. PARKER, LEO ZIMMERMAN and SAMUEL GOLDBERG
 Operations
 B. PORTIS Thyroid surgery
 SAMUEL PERLOW Peripherovascular surgery
 A. A. STRAUSS, S. STRAUSS and J. PATEJDL Gastro intes-
 tinal surgery
 RALPH B. BETTMAN and WILLIAM TANNENBAUM Gall
 bladder operations

Dry Clinic Surgery of the Gall Bladder

SAMUEL SOSKIN The preparation of the liver for surgery
 R. A. ARENS The technique of cholecystography
 M. SERBI, S. PORTIS and G. LICHTENSTEIN The evalua-
 tion of liver function tests, gall bladder diet, survey of
 postoperative results of the gall bladder group
 RALPH B. BETTMAN, LEO ZIMMERMAN and WILLIAM TAN-
 NENBAUM Motion picture and diagrammatic demon-
 strations The technique of cholecystectomy, choledoco-
 tomy, choledochogastrostomy or enterostomy

RESEARCH AND EDUCATIONAL HOSPITALS

W. H. COLE Thyroidectomy, operation for pyloric
 obstruction
 P. J. SARMA and H. L. MISHKIN Clinic on varicose veins
 Symposium Diseases of the Thyroid
 W. H. COLE Pre operative care and postoperative com-
 plications
 C. B. PUESTOW Use of silk in thyroidectomy
 L. SEED and R. BRUNNER Blood pressure studies during
 thyroidectomy
 J. M. MORA Hepatic damage in hyperthyroidism
 R. W. KEETON Cardiac complications of hyperthyroidism
 W. H. COLE Tracheal collapse
 JOHN HOWE The thyroid gland as observed at autopsy in
 patients with diseases other than hyperthyroidism
 J. H. BAILEY Bacteriological studies in the operating
 room

ST ANNE'S HOSPITAL

THOMAS E. MEANY Fractures and tendon transplanta-
 tions
 JOHN L. KNAPP and JOHN W. KEANE Surgical clinic,
 demonstration of cases
 GEORGE F. THOMPSON Surgical clinic, demonstration of
 cases

ST ANTHONY DE PADUA HOSPITAL

S E DONOVAN and H P SULLIVAN Operations and demonstration of cases

ST BERNARD'S HOSPITAL

G M CUSHING The surgical treatment of perforated gastric ulcer

ST LUKE'S HOSPITAL

H E JONES WILL LYON WILLIAM R CUBBINS and associates Operations

U S MARINE HOSPITAL

O E MADEAU Results in hernia surgery
E C LUSTON and R W FLANN Spinal anesthesia demonstration

WESLEY MEMORIAL HOSPITAL

WILLIAM MILLER Review of gall bladder surgery

FRANCES E WILLARD HOSPITAL

VICTOR L SCHRAGER Clinic

WOMEN AND CHILDREN'S HOSPITAL

PEARL M STEILER Abdominal surgery

Wednesday Afternoon

COLUMBIUS HOSPITAL

D A ORTH C J SCHERIBEL and F D VORA Experimental thyrotoxicosis
J L SPENCER Valve operation

MICHAEL REESE HOSPITAL

Symposium

SAMUEL PERLOW Paravertebral alcohol injections for the relief of cardiac pain
LEO ZIMMERMAN and ORTO SAPHIR Benign tumors of the thyroid gland
SAMUEL GOLDBERG Acute mesenteric lymphadenitis strangulated hernias in premature infants
THOMAS J MILLER Rectal complications of lymphogranuloma inguinale
CASPER EDEL Fractures of the jaws
M L PARKER Carcinoma of the large bowel

ST ANNE'S HOSPITAL

HARRY J DOOLY Logical clinic demonstration of cases
JOHN J CEARL and E P GRAMER Surgical clinic demonstration of cases

ST BERNARD'S HOSPITAL

HERMAN DEFEO The medical management of cholecystic diseases
B C CLISHAW and associates Roentgen studies of gall bladder diseases
S L GOVERNALE Cholecystectomy versus cholecystectomy
CHESTER GUY Pathology of the gall bladder

ST LUKE'S HOSPITAL

S W McARTHUR and associates Bile tract and colon surgery

WESLEY MEMORIAL HOSPITAL

GUY S VAN ALSTYNE Abdominal surgery

FRANCES E WILLARD HOSPITAL

LOUIS F PLEAK Clinic

Thursday Morning

AUGUSTANA HOSPITAL

N M PERCY Operations

CHICAGO MEMORIAL HOSPITAL

PETER S CLARK, LEO M ZIMMERMAN and M L WEISTERN Gall bladder surgery

COOK COUNTY HOSPITAL

RICHARD H JAFFE Pathological conference
KARL A MEYER GEORGE G DAVIS ALBERT H MONTGOMERY and MAX THOREK Operations
Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine 427 S Honore Street

EVANGELICAL DEACONESS HOSPITAL

JOHN I IERL Stomach resection

HOLY CROSS HOSPITAL

J FRANCIS REZIC Coledochotomy and dilatation of common duct vaginal hysterectomy cholecystectomy
J FRANCIS REZIC D DICIRO and WALTER EISEN Resection of superior hypogastric ganglion
D DICIRO Kidney neoplasm
FRANCIS STREYSMAN Vagnectomy
JOHN SIMO UTIS Pelvic laparotomy

ILLINOIS MASONIC HOSPITAL

CHARLES DRUCK Pruritus ani—cases due to systemic disturbances Ovarian dysfunction (viscous pruritus) hypothyroidism spastic colon obesity

JACKSON PARK HOSPITAL

GEORGE M LUCAS Operations

LUTHERAN DEACONESS HOSPITAL

JOHN D KOECKY G H MUMFORD and GEORGE H SCHROEDER Operations

MERCY HOSPITAL

L D MOORHEAD Symposium Goiter

PASSAUNT MEMORIAL HOSPITAL

PAUL STARR Symposium Diseases of the endocrine glands

PRESBYTERIAN HOSPITAL

V C DAVID C B DAVIS WILLIAM MILLER and associates Operations
KELLOGG SPEED DR GATENOOD and A H MONTGOMERY Dry clinics and symposia

MICHAEL REESE HOSPITAL

A A STRAUSS and S STRAUSS Gastro-intestinal surgery
D C STRAUSS General surgery
Thyroid Symposium
D C STRAUSS Group study and demonstration of thyroid records surgical management of hyperthyroidism
S SOSKIN The endocrine disturbance in thyroid disease
L N KATZ Disordered physiology of the cardiovascular system in thyroid disease
M LEV Some clinical aspects of the heart in hyperthyroidism, medical management of hyperthyroidism
A S BOWLING and L N KATZ The electrocardiogram in thyroid disease
W W HAMBURGER Arrhythmias in thyroid disease

- B PORTIS Outpatient clinic management of hyperthyroidism
 B PORTIS and H ROTH Treatment of hyperthyroidism complicated by pregnancy and syphilis
 R LEVINE Experimental treatment of hyperthyroidism

RESEARCH AND EDUCATIONAL HOSPITALS

- C B PUESTOW Operations Cholecholestomy, carcinoma of rectum
 Symposium Gall Bladder Diseases
 C B PUESTOW The effect of cholecystectomy on pressure in the choleliths, gall bladder fistulae
 EDMUND FOLEY Differential diagnosis between intra hepatic and extrahepatic jaundice
 W H COLE The role of cystic duct obstruction to gall bladder disease
 A HARTUNG The advantage of combining gastro intestinal series with cholecystography

ST ANTHONY DE PADUA HOSPITAL

- F B OLEVINE Operations and demonstration of gouter and abdominal surgery cases

ST JOSEPH'S HOSPITAL

- WILLIAM C BECK Thoracic surgery
 AUSTIN A HAYDEN Conservation of hearing, mastoid and sinus surgery
 ARCHIBALD HOYNE Control of contagion in surgical diseases
 WILLIAM H G LOGAN Oral surgery
 FRANKLIN B MCCARTY Gall bladder surgery
 CHARLES M MCKENNA Undescended testicle
 HUGH MCKENNA Fractures conservative surgery in diabetic gangrene
 FRANK THEIS Peripheral circulatory diseases
 Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES pathologist and WILLIAM E ANSPACH, radiologist

ST MARY OF NAZARETH HOSPITAL

- J C HILL Pathologic discussion of operative findings
 T LARKOWSKI Symposium Hernias and their repair

VETERANS ADMINISTRATION FACILITY

- PAUL F BROWN Operations

WESLEY MEMORIAL HOSPITAL

- R W MCNEALY and associates Surgery of jaundiced patients
 GUY S VAN ALSTYNE Carcinoma of the breast, combined surgical and x ray treatment

FRANCES E WILLARD HOSPITAL

- A E STEWART Clinic

WOMEN AND CHILDREN'S HOSPITAL

- PEARL M STETLER and MARIE ORTMAYER Gastro intestinal clinic gastroscopic technique
 ALICE CONKLIN Thyroidectomy
 ESTHER RAHM Repair of ventral hernia

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

- BENNETT R PARLER, LEO M ZIMMERMAN, WALTER S PRIEST, OTTO SAPHIR and GEORGE M LANDAU Symposium Thyroid disease
 FRANK WRIGHT, ALBERT ZRUNE, LEO M ZIMMERMAN, M L WEINSTEIN and OTTO SAPHIR Symposium Blood transfusion

COOK COUNTY HOSPITAL

- RALPH B BETTMAN and EDWARD J LEWIS Operations

HOLY CROSS HOSPITAL

- J FRANCIS RUCIC Biliary tract surgery

MICHAEL REESE HOSPITAL

- Symposium Gastro Intestinal Surgery
 LEON BLOCH The medical treatment of ulcerative colitis
 A A STRAUSS The surgical management of ulcerative colitis
 S STRAUSS The use of ileostomy in ulcerative colitis and carcinoma of the colon
 OTTO SAPHIR Pathology of ulcerative colitis Discussion
 R ARENS X ray diagnosis of ulcerative colitis and peptic ulcer Discussion
 A A STRAUSS and H F BRUNSWANGER Medical and surgical treatment of terminal ileitis

RESEARCH AND EDUCATIONAL HOSPITALS

- Symposium Diseases of the Gastro Intestinal Tract
 GEORGE MILLES Pathology of carcinoma of stomach
 W H COLE Total gastrectomy
 T J WACHOWSKI X ray diagnosis of carcinoma of stomach
 C L BIRCH Anemia associated with total gastrectomy
 M H STREICHER Diagnosis of carcinoma of the rectum
 C B PUESTOW Surgical treatment of carcinoma of the rectum
 BERNARD PORTIS Surgical treatment of complicated duodenal ulcers
 F L McMILLAN Regional ileitis
 J L SPIVACK Tuboalvular stoma with particular reference to gastrostomy
 H O WERNICKE The injection treatment of hernia

ST ANTHONY DE PADUA HOSPITAL

- W H BRADLEY Operations

ST BERNARD'S HOSPITAL

- W S HECTOR and S S DUBOV Imperforate anus with atresia of large bowel

ST MARY OF NAZARETH HOSPITAL

- A PARTIPILO Aseptic gastro intestinal anastomosis
 P CZWALINSKI Surgical incisions
 J TEVOZAR Abdominal operations

WESLEY MEMORIAL HOSPITAL

- C B PERRY and H E C BARNARD Abdominal surgery

FRANCES E WILLARD HOSPITAL

- OTIS M WALTER Clinic

WOMEN AND CHILDREN'S HOSPITAL

- EMELIA GRIYOTAS Cholecystectomy

Friday Morning

ALBERT MERRITT BILLINGS HOSPITAL

- Presentation on Surgery and the Circulation
 H LIVINGSTONE Anesthesia and the circulation
 N ROOMIE, H WILSON, H N HARLANS and D B PHEASTER Studies in causes and treatment of surgical shock
 W F ADAMS Intrathoracic operation and the circulation

COLUMBUS HOSPITAL

- M J SEIFERT and F K O'MALLEY Gastro intestinal surgery

COOK COUNTY HOSPITAL

DR. GATEROOD Children's surgery
RALPH C. SULLIVAN VERNON C. DAVID HARRY JACKSON
and FRANK J. JIRKA Operations

Members of the surgical staff will give demonstrations
in surgical technique upon *cadavers* and *dogs* in the labora-
tories of the Graduate School of Medicine 427 S. Honore
Street

HOLY CROSS HOSPITAL

FRANK FRAIDER and NICHOLAS PAVLETIC Hysterectomy
cesarean section cholecystectomy
STEPHEN BILZIS Cholecystectomy hysterectomy repair
of incisional hernia
FELIX WINSEKAS Inguinal herniorrhaphy
JAMES GALLAGHER Cholecystectomy
WILLIAM REILLY Cholecystectomy and appendectomy
M. J. BADZIEWERONSKI and H. LEACE Hysterectomy

ILLINOIS MASONIC HOSPITAL

CHARLES H. PARKES CARL F. STEINHOFF and WALTER C.
BORNEMEIER Surgical diabetes—organization of the
service for the care of the surgical diabetic where an
intimate relationship exists between the surgeon and the
internist which is greater than that of a consultation
review of cases on service for past ten years presentation
of treatment involved in surgical diabetes protomune
insulin anesthesia operative and postoperative cases
lower extremity

JOHN R. HARGER and JOHN H. GILMORE Gall bladder
surgery—history building Personal history in detail
laboratory findings and practical values of various tests
x ray development to date in this diagnostic field dem-
onstration of operative technique with use of pendural
route for anesthesia in the cases discussion of advantages
of pendural anesthesia over spinal and lessening of haz-
ard greater satisfaction than with any type of general

JACKSON PARK HOSPITAL

ARRIE BAMBERGER H. HOLT COX and C. CLARA Opera-
tions

LUTHERAN DEaconESS HOSPITAL

JOHN D. KOLCZY G. H. MAXWELL and GEORGE H.
SCHROEDER Operations
GEORGE O. SOLEM Surgical indications in peptic ulcer

MOUNT SINAI HOSPITAL

A. A. STRAUSS S. F. STRAUSS and B. SAYRE Operations
M. LEWISON Surgery in patients with cardiovascular
diseases
H. J. ISAACS Coronary disease simulating acute abdomi-
nal catastrophes
L. B. FRELICH Surgery in tuberculosis
I. DAVIDSON Clinical pathological conference

PASSAVANT MEMORIAL HOSPITAL

SAMUEL J. FOELLSON Experimental surgical problems

POSTGRADUATE HOSPITAL

L. ZIMMERMAN Varicose veins and their complications

PRESBYTERIAN HOSPITAL

V. C. DAVID KELLOGG SPEED C. B. DAVIS DR. GATE-
WOOD WILLIAM MILLER and A. H. MONTGOMERY
Operations

MICHAEL REESE HOSPITAL

J. PATEJDI P. SHAPIRO R. CRAWFORD B. PORTIS S.
GOLDBERG M. L. PARKER and LEO ZIMMERMAN Oper-
ations

RESEARCH AND EDUCATIONAL HOSPITALS

R. B. MALCOLM Operative clinic Neck dissection carci-
noma of breast surgical pathology of breast tumors.
Clinical Demonstration
T. J. WACHOWSKI x ray treatment of carcinoma of the
breast
ARRIE BAMBERGER Ewing tumor with case report
S. R. ROSENTHAL The toxin and antitoxin of burns
W. H. COLE Acute pancreatitis

ST ANTHONY DE PADUA HOSPITAL

J. J. SPRAFAA Abdominal surgery and demonstration of
cases

ST ELIZABETH'S HOSPITAL

E. D. KALFELAGE Thyroid disease

ST LUKE'S HOSPITAL

E. W. HIRSCH E. JENKINSON and staff Staff clinic

WESLEY MEMORIAL HOSPITAL

EARL LATIMER Unusual breast tumors

Friday Afternoon

COOK COUNTY HOSPITAL

J. G. FROST Operations
SILVER L. KOCH Surgery of the hand
F. H. WARFENSKI Operations

HOLY CROSS HOSPITAL

CHARLES GALANTY Osteogenic sarcoma
EARL WEISS Splenomegaly

JACKSON PARK HOSPITAL

HARRY E. L. TIMM Operations

MOUNT SINAI HOSPITAL

I. DAVIDSON Differential diagnosis of infectious mono-
nucleosis simulating surgical conditions demonstration
of technique

ST BERNARD'S HOSPITAL

J. M. MAHOVEY Infective granuloma of the cecum simu-
lating a neoplasm case demonstration

ST ELIZABETH'S HOSPITAL

J. K. KARAT Pre and postoperative intravenous admin-
istration of fat emulsion

Days to be Announced

COOK COUNTY HOSPITAL

VICTOR L. SCHRAGER Symposium Appendicitis
SILVER L. KOCH Symposium Hand infections
HARRY JACKSON Symposium Skull fractures
EDWIN M. MILLER Symposium Children's surgery
FREDERICK G. DIAS Symposium Peritonitis
MARSHALL DAVIDSON Symposium Diseases of the thyroid
gland
VERNON C. DAVID Symposium Surgery of the large
bowel

HENROTIN HOSPITAL

JOHN A. GRAHAM Demonstration clinic

GYNECOLOGY AND OBSTETRICS

Monday Afternoon

CHICAGO LYING IN HOSPITAL

FRED L ADAIR and staff Motion picture demonstration of cesarean section

COOK COUNTY HOSPITAL

FREDERICK H FALLS Operations
A F LASH Puerperal sepsis, ward walk

HOLY CROSS HOSPITAL

PAUL LAWLER Application of obstetrical forceps (manikin demonstration)

ILLINOIS MASONIC HOSPITAL

HAROLD W MILLER and WALTER BORNEMEYER Ovarian cysts, uterine fibroids Dry clinic for demonstration of cases and general discussion, operation during which use and value of peritoneoscope will be demonstrated
F O BOWE and BEULAH WALLIN Cesarean section Indications, comparison of results in different types, demonstration of operative technique of low cesarean section

ST BERNARD'S HOSPITAL

E A RACH and F J STUCKER Cesarean section

WOMEN AND CHILDREN'S HOSPITAL

ANNIE E BLOUNT Operations

Tuesday Morning

CHICAGO LYING IN HOSPITAL

FRED L ADAIR, WILLIAM J DIECKMANN, M EDWARD DAVIS, H C HESSELTINE and staff Cesarean section Motion picture demonstration of colpocleisis operation

COOK COUNTY HOSPITAL

CAREY CULBERTSON and A E KANTER Operations
D S HILLIS Treatment of abortion, ward walk

PRESBYTERIAN HOSPITAL

N S HEANEY, CAREY CULBERTSON, A E KANTER, E D ALLEN and H BOYSEN Operations

MICHAEL REESE HOSPITAL

J L BAER, J E LACNER, WILLIAM RUBOVITS, I F STEIN and RALPH REIS Operations

ST LUKE'S HOSPITAL

H O JONES and associates Clinic

WESLEY MEMORIAL HOSPITAL

MARK GOLDSTINE and associates Uterine bleeding

FRANCES E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

MARY EDITH WILLIAMS Removal of abdominal and pelvic tumors
OTTILLIE ZELEVNY Electrocoagulation of the cervix uteri

Tuesday Afternoon

CHICAGO LYING IN HOSPITAL

WILLIAM J DIECKMANN and staff Dry clinic Eclampsia Motion picture demonstration of forceps delivery

COOK COUNTY HOSPITAL

J P GREENHILL Operations
I RUDOLPH and J H BLOOMFIELD Symposium The toxemias of pregnancy

ST BERNARD'S HOSPITAL

S S SCHOCHET Fibroids

ST ELIZABETH'S HOSPITAL

J R LAVIERI Cesarean section

ST MARY OF NAZARETH HOSPITAL

L KOZAKIEWICZ and M UZNANSKI Toxemias of pregnancy

FRANCES E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

ELOISE PARSONS Vaginal hysterectomy, vaginal sterilization, ligation of tubes per vaginal route

Wednesday Morning

CHICAGO LYING IN HOSPITAL

FRED L ADAIR, WILLIAM J DIECKMANN, M EDWARD DAVIS, H C HESSELTINE and staff Operations and demonstration of cases

COOK COUNTY HOSPITAL

C W BARRETT Operations
J E FITZGERALD Heart disease in pregnancy, ward walk

EVANGELICAL DEACONESS HOSPITAL

A J SCHOENBERG Hysterectomy

JACKSON PARK HOSPITAL

CHARLES F GREENE, LOUIS H STERN, W J NIXON DAVIS, JR and NORMAN ZOLLA Treatment of contracted pelvis by cesarean section, version and forceps

PASSAVANT MEMORIAL HOSPITAL

GEORGE GARDNER and ARTHUR H CURTIS Gynecological pathology—demonstration and conference

PRESBYTERIAN HOSPITAL

N S HEANEY, CAREY CULBERTSON, A E KANTER, E D ALLEN and H BOYSEN Demonstration of cases

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS Eclampsic toxemia, low cervical cesarean section under local anesthesia
W H BROWNE Progesterin in the treatment of abortion
G H REZEK Modification of the Friedmann reaction

MICHAEL REESE HOSPITAL

Dry Clinic

JOSEPH L BAER Shifting trends in the treatment of prolapse of the uterus
JULIUS E LACNER Recent investigations in the action of progesterone
WILLIAM H RUBOVITS Postoperative vaginal antiseptics
IRVING F STEIN Evaluation of the "safe period"
RALPH A REIS Mammography
LESTER E FRANKENTHAL, JR Treatment of vulvovaginitis

- MICHAEL L. LEVENTHAL. The Manchester operation for the cure of cystocele and prolapse
 HENRY BOXBACH. The role of spermatoxins in temporary sterility
 A. F. LASH. Early diagnosis of carcinoma of the uterus.
 E. J. DE COSTA. The use of progesterone in the prevention of habitual abortion
 ALFRED J. KOBAC. Maternal mortality in Chicago
 HERMAN STRACAS. Routine palpation of the ureters during hysterectomy

WESLEY MEMORIAL HOSPITAL

- CHARLES B. REED, WILLIAM B. SERBIN and G. C. RICHARDSON. Moving picture demonstration of low forceps breech extraction with forceps on aftercoming head spontaneous breech—manual and.

WOMEN AND CHILDREN'S HOSPITAL

- FLORENCE HARE. Prenatal care with reference to the baby
 RUTH R. DARROW. Treatment of icterus gravis.
 BERTHA VAN HOODEN. Maternity mortality

Wednesday Afternoon

CHICAGO LYING-IN HOSPITAL

- H. C. HESSELTINE and staff. Nonconvulsive toxemia of pregnancy. Motion picture demonstration of birth injury

CHICAGO MEMORIAL HOSPITAL

- PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, BEATRICE E. TUCKER and WALTER WIDBORG. Plastic repair
 JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON. Cesarean section

COOK COUNTY HOSPITAL

- W. T. CARLISLE. Operations
 D. S. HILLIS, J. H. BLOOMFIELD and A. F. LASH. Symposium. Cesarean section

RESEARCH AND EDUCATIONAL HOSPITALS

- FREDERICK H. FALLS and staff. Operations. Symposium. Gynecological tumors
 FREDERICK H. FALLS. Vulva carcinoma demonstration of cases vulvectomy under local anesthesia
 R. A. LUYENBART. Solid tumors of ovary removal of ovarian cyst
 H. H. HILL. Early carcinoma of cervix

WOMEN AND CHILDREN'S HOSPITAL

- CONSTANCE O. BRITIS. Operations
 BERTHA VAN HOODEN and MARGIE HALL WENNETT. Anesthesia in obstetrics.
 BEATRICE E. TUCKER. Parasacral anesthesia

Thursday Morning

CHICAGO LYING-IN HOSPITAL

- FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Cesarean section. Motion picture demonstration of blood transfusion

CHICAGO MEMORIAL HOSPITAL

- PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, BEATRICE E. TUCKER and WALTER WIDBORG. Symposium. The treatment of prolapse of the uterus, cystocele and rectocele at various ages.
 JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON. Indications and technique for cesarean section. nerve block in obstetrics

COOK COUNTY HOSPITAL

- EGON W. FISCHMANN. Operations.
 J. E. FITZGERALD and L. REDOLPH. Symposium. Ectopic pregnancy its diagnosis and treatment

MOUNT SINAI HOSPITAL

- A. H. KLAUWAS. Endometriosis.
 A. E. KANTER. Masculinizing tumors of ovary
 A. F. LASH. Pelvic infections
 A. H. E. GOLDSTEIN, C. NEWBERGER, H. BOXBACH and associates. Symposium. Obstetrical hemorrhages.
 L. REDOLPH. Physiological and clinical aspects of occiput-posterior position
 A. ARKIN, I. A. RABEAS and R. GORDON. Medico-surgical discussion

FRESBYTERIAN HOSPITAL

- N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYDEN. Operations

ST ANTHONY DE PADUA HOSPITAL

- M. A. WEISSKOPF. Operations

WASHINGTON BOULEVARD HOSPITAL

- PAUL C. FOX. Operations and demonstration of cases

WESLEY MEMORIAL HOSPITAL

- MARK GOLDSTEIN and associates. Vaginal plastics.

Thursday Afternoon

CHICAGO LYING-IN HOSPITAL

- M. EDWARD DAVIS and staff. Placenta previa abruptio placentae. Motion picture demonstration of postpartum hemorrhage.

COOK COUNTY HOSPITAL

- FREDERICK H. FALLS. Operations
 J. H. BLOOMFIELD and D. S. HILLIS. Symposium. Late hemorrhages of pregnancy

ST MARY OF NAZARETH HOSPITAL

- H. LITTLE. Ovarian tumors

Friday Morning

CHICAGO LYING-IN HOSPITAL

- FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Cesarean section. Dry clinic

COOK COUNTY HOSPITAL

- A. E. KANTER and CAREY CULBERTSON. Operations
 A. F. LASH. Toxemia of pregnancy. ward walk

FRESBYTERIAN HOSPITAL

- N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYDEN. Operations

MICHAEL REESE HOSPITAL

- J. L. BAER, J. E. LACKNER, WILLIAM REBOVITS, I. F. STEIN and RALPH REIL. Operations

ST BERNARD'S HOSPITAL

- J. B. HARTMAN. Hysterectomy and its indications

WESLEY MEMORIAL HOSPITAL

- CHARLES B. REED, WILLIAM B. SERBIN and G. C. RICHARDSON. Ablation placenta placenta previa.

WOMEN AND CHILDREN'S HOSPITAL

BERTHA VAN HOOSSEN and MAUDE HALL WIMMETT
Surgical cases complicating obstetrics

Friday Afternoon

CHICAGO LYING IN HOSPITAL

FRED L. ADAIR and staff Dry clinic Motion picture
demonstration of episiotomy

COOK COUNTY HOSPITAL

CAREY CULBERTSON Operations
L. RUDOLPH Symposium Prolonged labor, constriction
ring dystocia

MERCY HOSPITAL

H. E. SCHMITZ and associates Symposium on operative
gynecology

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H. FALLS and staff Symposium Gynecological
plastic operations with special reference to the use of
local anesthesia

FREDERICK H. FALLS Vaginal hysterectomy for proci-
denta under local anesthesia

M. J. SUMMERSVILLE Anterior colporrhaphy and interposi-
tion operation under local anesthesia

WILLIAM H. BROWNE Sturmdorf Kelly incontinence
operation and perineorrhaphy under local anesthesia

WOMEN AND CHILDREN'S HOSPITAL

CATHERINE TRUE Abdominal gynecological cases
ELOISE PARSONS Treatment of sterility, treatment of
eroded cervix by cautery, lipiodol visualization of
uterus and tubes.

Days to be Announced

COOK COUNTY HOSPITAL

J. P. GREENHILL, C. W. BARRETT, W. T. CARLISLE, E. CON-
W. FISCHMANN, FREDERICK H. FALLS, A. E. KANTER
and CAREY CULBERTSON Symposium on fibroids

HENROTIN HOSPITAL

EDWARD L. CORNELL Operations and demonstration of
cases

CHANNING W. BARRETT and LEE STONE Operations and
demonstration of cases

ORTHOPEDIC SURGERY

Monday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

H. B. THOMAS, F. W. HARK and C. N. LAMBERT Sym-
posium Tenodesis Operations and demonstration of
cases, tendon transplantations

Tuesday Morning

CHILDREN'S MEMORIAL HOSPITAL

F. CHAMBLER, F. SEIDLER, C. PEASE and J. NORCROSS
Operations and demonstration of cases

COLUMBUS HOSPITAL

E. H. SLOTT and I. E. SLOTT Sciatica

COOK COUNTY HOSPITAL

ARTHUR COVLEY Operations and symposium with demon-
stration of cases, blind pegging of hip for fracture of neck
of femur, using Kirschner wire and Smith Petersen nail,
problems in diagnosis of bone tumors, painful back in
medicolegal cases, persistent dizziness following head
injuries, fractures in and about the ankle

MARCUS H. HOBART Operation Removal of internal semi-
lunar cartilage Demonstration of cases. Recurrent dis-
locations of the shoulder, internal derangement of the
knee joint, spinal fusions and low back pain, acquired
dislocations of the hip following scarlet fever, syn-
dactylism

PRESBYTERIAN HOSPITAL

E. J. BERKHEISER Dry clinic and demonstration of cases

MICHAEL REESE HOSPITAL

PHILIP LEWIN, DANIEL LEVINthal, CHARLES PEASE,
F. GLASSMAN, STONEY SIDEMAN, JEROME G. FINDER and
I. WOLIN Operations

Tuesday Afternoon

MOUNT SINAI HOSPITAL

C. JACOBS Orthopedic demonstrations
L. MILLER Visualization of joints

J. FINDER Giant cell tumor of bone
F. GLASSMAN Nonunion of neck of femur

WESLEY MEMORIAL HOSPITAL

F. M. JANSEY, H. KELIKIAN and O. H. HORRALL Bone
and joint surgery

Wednesday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VARTIAK. Indications for surgical treatment of
arthritis

MUNICIPAL TUBERCULOSIS SANITARIUM

E. J. BERKHEISER Bone tuberculosis

ST BERNARD'S HOSPITAL

L. B. DOVKE and M. E. CREIGHTON Fractures of the
shaft of the femur

WESLEY MEMORIAL HOSPITAL

PHILIP H. KREUSCHER and associates Bone and joint
surgery, knee injuries

Wednesday Afternoon

EVANSTON HOSPITAL

J. L. PORTER and R. C. LONERGAN Low back disorders

MERCY HOSPITAL

J. D. CLARIDGE and associates Problems in orthopedic
and traumatic surgery

PASSAVANT MEMORIAL HOSPITAL

EMIL HAUSER and associates Surgery of the knee and
foot—demonstration of cases and lantern slides. Total
tendon transplant for slipping patella, injuries of the
external semilunar cartilage, loose body, the result of a
semilunar cartilage injury, manipulative correction of
deformity, tendon transplant as a routine procedure to
triple arthrodesis of the paralytic foot, reconstruction
operation for hallux valgus

PRESBYTERIAN HOSPITAL

J J BERKHEISER KELLOGG SPEED and D RIDER
Operations

MICHAEL REESE HOSPITAL

PHILIP LEWIN Fracture problems new approach for arthrodesis of knee joint discussion of bone tumors motion picture demonstration of manipulative surgery
SIDNEY SIDEMAN Rice bodies in tendon sheath of the hand Hoke stabilization of the foot spastic paralysis roentgenologic library of the hip joint fusion operation in tuberculosis of the knee joint bunion operation multiple cartilaginous exostosis

DANIEL H LEVINTHAL and IRVING WOLIN Tendon transplantation in poliomyelitis spastic paralysis recurrent dislocation of shoulder flat feet demonstration of arthroplasties of the knee hip and elbow knee joint surgery

CHARLES PEASE Acute transverse atrophy of bone traumatic rupture of intervertebral disc reduction of compression fracture of spine osteochondromatosis of the elbows

JEROME G FINDER Chondromyxosarcoma two cases flexorplasty of the thumb for paralytic opposition pollicis osteochondroma of the tibia McBride bunion plasty unusual bone tumor (?) of femur key operation for soft corns spastic paralysis—bilateral adductor tenotomy and obturator nerve neurectomy case with unusual deformities

FRANK GLASSMAN Fracture and dislocation of shoulder supracondylar fracture of the humerus fracture of the neck of the femur complete fracture of the tibia and fibula removal of the head of the radius three cases osteoma of the femur demonstration of various types of fractures and treatment

ST ANTHONY DE PADUA HOSPITAL

THOMAS DWYER New bone biopsy trephine pathological specimens

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Bone and Joint Surgery

E L COMPERE Leg lengthening operation, technique and results spinal fusion in the correction of scoliosis

C H HATCHER The pathology and treatment of tuberculous arthritis studies in the rate of skeletal growth and equalization of limb length

H N HARKINS Bone graft operations for ununited fracture

P C BLYC and R B CLOWARD Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis

C B HOGGINS Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton

COOK COUNTY HOSPITAL

DANIEL H LEVINTHAL Bone graft surgery for nonunion stabilization and benign bone tumors Motion picture demonstration Surgical treatment of spastic paralysis surgical treatment of residual paralysis following poliomyelitis

PHILIP H KREUSCHER Nicola operation semilunar cartilage derangement spinal grafts new operation for hip fusion new operation for knee fusion

PHILIP LEWIN Tunnel skin graft over os calcis spondylolisthesis, stabilization of paralytic varus foot arthrodesis of ankle joint hallux varus tuberculous spine fusion infantile paralysis low back pain with sciatica

FRANK G MURPHY Skin grafts for old wounds of leg unusual bone tumors fracture into ankle joint mal union of Colles fracture tuberculosis of cuneiform bone scar contracture of forearm skin graft

ILLINOIS MASONIC HOSPITAL

CHARLES V PEASE and EDGAR WHITE Tuberculosis of the knee fractures about the elbow in children reduction of fractures of the spine traumatic rupture of the intervertebral disc

MICHAEL REESE HOSPITAL

PHILIP LEWIN DANIEL LEVINTHAL CHARLES PEASE, F GLASSMAN J WOLIN SIDNEY SIDEMAN and JEROME G FINDER Operations

ST BERNARD'S HOSPITAL

S L GOVERNALL Pseudomuscular dystrophy case demonstration

J G FROST Metastatic hypernephroid carcinoma of the femur

R S WESTLINE and L L ARENSDORF Fractures of the wrist joint

ST MARY OF NAZARETH HOSPITAL

L CZAJA Clinic

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Operations

Thursday Afternoon

COOK COUNTY HOSPITAL

E J BERKHEISER Operations and demonstration of cases—spondylolisthesis, anterior poliomyelitis arthrodesis and tendon transplantation

PRESBYTERIAN HOSPITAL

E J BERKHEISER and D RIDER Operations

RESEARCH AND EDUCATIONAL HOSPITALS

H B THOMAS F W HARK and C N LAMBERT Operation Shelving of a congenital dislocated hip Demonstration of patients with closed reduction open reduction and shelving of congenital dislocation

ST LUKE'S HOSPITAL

E W RYERSON and associates Demonstration of cases

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Bone tumors

Friday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VETLIK Indications for surgical treatment of arthritis

PRESBYTERIAN HOSPITAL

E J BERKHEISER KELLOGG SPEED and D RIDER Operations

ST BERNARD'S HOSPITAL

CHESTER C GUY Surgical pathology of bone tumors

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Maggot treatment of osteomyelitis

GENITO-URINARY SURGERY

Monday Afternoon

COLUMBUS HOSPITAL

WILLIAM GILL, FRANK L. CHENOWETH, H. E. DAVIS and
I. F. VOLINI Resectoscope for bladder carcinoma

Tuesday Morning

MOUNT SINAI HOSPITAL

H. POLNICK, H. SOLOWAY and E. HIRSCH Symposium
Tumors of the kidney

PASSAVANT MEMORIAL HOSPITAL

L. L. VESELY, V. L. LESPINASSE, HARRY CULVER and FRED
LIEBERTHAL Symposium Tuberculosis of the urinary
tract

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTADT, H. ROLNICK, I. SHAPIRO, J.
GROVE, F. LIEBERTHAL and A. E. JONES Symposium
Carcinoma of the urinary bladder

ST. JOSEPH'S HOSPITAL

CHARLES M. McKENNA Undescended testicle

ST. MARY OF NAZARETH HOSPITAL

J. WELFELD Urologic clinic Malignancy of tumors of
the bladder in children

WESLEY MEMORIAL HOSPITAL

V. D. LESPINASSE and associates Clinic

WOMEN AND CHILDREN'S HOSPITAL

MARIE ORTMAYER and PEARL M. STETLER Clinic

Tuesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

C. M. McKENNA, R. D. HERFOLD and staff Operations
and demonstrations Experimental and clinical studies
on various types of urinary antiseptics, anomalies with
special reference to undescended testicle and hypospadias

ST. ANTHONY DE PADUA HOSPITAL

O. J. JIRSA Prostatic management, carcinoma of bladder
pyelography

Wednesday Morning

CHICAGO MEMORIAL HOSPITAL

J. WILLIAM PARKER and JOHN P. O'NEIL Operations

COOK COUNTY HOSPITAL

HARRY CULVER, L. L. VESELY, CHARLES McKENNA and
HARRY POLNICK Operations

GARFIELD PARK HOSPITAL

VINCENT J. O'CONNOR, C. C. SAEHLHOF and associates More
recent advances in infections in the urinary tract

MERCY HOSPITAL

H. E. LANDES Symposium Transurethral resection
J. E. LAUBE and associates Kidney anomalies treatment
of neoplasms of the urinary tract

MUNICIPAL TUBERCULOSIS SANITARIUM

DORRIN RUDNICK Tuberculosis of the genito urinary
tract

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTADT, H. ROLNICK, I. SHAPIRO, J.
GROVE, F. LIEBERTHAL and A. E. JONES Operations

WASHINGTON BOULEVARD HOSPITAL

VINCENT J. O'CONNOR Dry clinic

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL

J. WILLIAM PARKER, JOHN P. O'NEIL, E. J. STIEGLITZ,
D. G. BRUNJES, OTTO SAPHIR and GEORGE M. LANDAU
Symposium Kidney infections
M. L. WILSTEIN, J. WILLIAM PARKER and JOHN P.
O'NEIL Transurethral resection of the prostate
R. A. MELENDA, J. WILLIAM PARKER, JOHN P. O'NEIL and
OTTO SAPHIR Tuberculosis of the genito urinary tract
in males

EVANSTON HOSPITAL

J. I. FARRELL Undescended testicles

ST. ANNE'S HOSPITAL

HARRY J. DOOLEY Urological clinic and demonstration of
cases

ST. BERNARD'S HOSPITAL

ANDREW SULLIVAN Operations

ST. ELIZABETH'S HOSPITAL

F. G. McDONOUGH Carcinoma of the bladder

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL

HERMAN L. KRETSCHMER and K. BARBER Operations and
demonstration of cases

COOK COUNTY HOSPITAL

HARRY CULVER and CHARLES McKENNA Symposium
Chronic bladder neck obstruction in the male

ILLINOIS MASONIC HOSPITAL

EDWARD W. WHITE, ROBERT H. HAYES and JOHN H.
GILMORE Renal tuberculosis Avenues of transmission,
discussion of the pathogenesis and morbidity, primary
foci and complicating factors in relation to general
tuberculosis, roentgenological aspects concerning pro-
static resection

CLARENCE C. SAEHLHOF and JOHN H. GILMORE Carcinoma
of bladder—diagnosis, type of treatment and approach,
result and cases renal calculus—multiple stone in redupli-
cated pelvis, diagnosis, treatment by heminephrectomy,
operative cases malignancy of prostate gland—diagno-
sis, method of immediate relief for obstructive symptoms,
postoperative radiation therapy and results, cases,
roentgenological advances in urologic diagnosis

JACKSON PARK HOSPITAL

WILLIAM YONKER. Transurethral prostatic resection compared to other types of prostatic surgery

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Operations

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTADT, H. ROINICK, I. SHAPIRO, J. GROVE, F. LIEBERTHAL and A. E. JONES. Operations.

ST JOSEPH'S HOSPITAL

CHARLES M. McKENNA. Undescended testicle

ST LUKE'S HOSPITAL

L. W. SCHMIDT and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY

T. G. McDUGGALL. Carcinoma of the bladder

WESLEY MEMORIAL HOSPITAL

V. D. LESPINASSE and associates. Clinic.

FRACTURES AND TRAUMATIC SURGERY*Monday Afternoon***COOK COUNTY HOSPITAL**

WILLIAM R. CUBBINS and associates. Operative fractures.

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENNA and M. J. MILLS. Traumatic surgery

ST ANTHONY DE PADUA HOSPITAL

F. W. SLOBE. Fractures, special phases of traumatic surgery

*Tuesday Morning***CHICAGO MEMORIAL HOSPITAL**

ARTHUR H. CONLEY and S. PERRY ROGERS. Symposium. Blind pegging of fractures of the femur

FRED MILLER, T. C. BROWNING, EMILE DUVAL and GEORGE M. LANDAU. Fracture of both bones of lower leg

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Ward walk.

ST JOSEPH'S HOSPITAL

HUGH McKENNA. Demonstration clinic.

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R. METZ. General surgery and fractures

*Tuesday Afternoon***CHICAGO MEMORIAL HOSPITAL**

C. R. G. FORRESTER, HORACE SIMON and A. H. MASON. Symposium. Fractures, nerve repair

COOK COUNTY HOSPITAL

STUMER L. KOCH and associate. Tendon and nerve suturing of the hand, hand infections.

VETERANS ADMINISTRATION FACILITY

S. K. LIVINGSTON. Dry clinic.

*Friday Morning***EVANGELICAL DEACONESS HOSPITAL**

PAUL MORR. Nephrolithotomy

ILLINOIS MASONIC HOSPITAL

C. OTIS RITCH. Nephrectomy, transurethral prostatic resection, urological clinic. Anomalies of upper urinary tract, bilateral and unilateral complete reduplication of kidneys and ureters, incomplete reduplication of kidneys and ureters, blind pelvis, ureteral bud, renal tuberculosis.

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY

T. G. McDUGGALL. Perineal prostatectomy

*Days to be Announced***COOK COUNTY HOSPITAL**

L. L. VESSEN and HARRY ROINICK. Symposium. Pyogenic infections of the upper urinary tract.

HEINROT HOSPITAL

DORRIN RUDNICK. Kidney complications in women.

*Wednesday Morning***COOK COUNTY HOSPITAL**

WILLIAM R. CUBBINS and associates. Ward walk. FREDERICK DYAS. Ward walk (female)

EVANSTON HOSPITAL

DWIGHT CLARK. Fractures about the knee joint.

ST ANNE'S HOSPITAL

THOMAS E. MEANY. Fractures and tendon transplantations.

ST BERNARD'S HOSPITAL

L. B. DONKLE and M. E. CRIGHTON. Fractures of the half of the femur

*Wednesday Afternoon***COOK COUNTY HOSPITAL**

WILLIAM R. CUBBINS, JAMES J. CALLAHAN, CARLO S. SCUDERI, FREDERICK DYAS and GEORGE L. APPELBAUGH. Symposium. Knee joint injuries.

PASSAVANT MEMORIAL HOSPITAL

PAUL B. MAGNUSON and JAMES B. STACE. Symposium on fractures.

*Thursday Morning***COOK COUNTY HOSPITAL**

WILLIAM R. CUBBINS and associates. Ward walk.

GARFIELD PARK HOSPITAL

J. J. CALLAHAN, H. N. WAIT and MILTON SCHMITT. Demonstration clinic

JACKSON PARK HOSPITAL

ARRIE BARKER. Demonstration clinic.

ST BERNARD'S HOSPITAL

R. S. WESTLINE and E. L. ARENSDOFF. Fractures of the wrist joint.

ST JOSEPH'S HOSPITAL

HUGH MCKENNA Demonstration clinic

ST MARY OF NAZARETH HOSPITAL

L. CZAJA Symposium Late results of fractures

U S MARINE HOSPITAL

HORACE P. STIMSON Ununited fractures with osteomyelitis

E. C. LUTTON and R. W. FLYNN Skeletal traction and countertraction in treatment of fractures

FRANCES E WILLARD HOSPITAL

JAMES A. VALENTINE Clinic

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

ARTHUR H. CONLEY and S. PERCY ROGERS Blind pegging of fractures of the femur

FRED MILLER, T. C. BROWNING, EMILE DUVAL and GEORGE M. LANDAU Fracture of both bones of the lower leg

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Operative fractures
GEORGE L. APPELBACH Ward walk (female)

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENMAN and M. J. MILLS Traumatic surgery

FRANCES E WILLARD HOSPITAL

FRED CARLS Clinic

WOMEN AND CHILDREN'S HOSPITAL

ARMINA HILL Minor injuries

MARY E. WILLIAMS Fractures, dislocations

Friday Morning

CHICAGO MEMORIAL HOSPITAL

C. R. G. FORRESTER, HORACE STIMSON and A. H. MASON Fractures nerve repair

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Follow up clinic, demonstration of cases

Friday Afternoon

COLUMBUS HOSPITAL

I. MUELLER Fractures

W. I. BEECHER Traumatic surgery

COOK COUNTY HOSPITAL

JAMES J. CALLAHAN and CARLO S. SCUDERI Cadaver demonstrations

Days to be Announced

COOK COUNTY HOSPITAL

DR. GATEWOOD Symposium Fractures in children

HENROTIN HOSPITAL

ARTHUR R. CONLEY Demonstration clinic

PLASTIC AND FACIOMAXILLARY SURGERY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER Plastic surgery of the nose

SIDNEY POLLACK Nasal fractures

BERNARD M. COHEN Nasal and ear prostheses

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

CASPER M. EPSTEIN Symposium Plastic, including facio-maxillary surgery

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER Demonstration of cases showing corrected temporomandibular ankylosis, harelips and cleft palates, pedicle flap and full thickness graft cases, repair of burns, traumatic injuries, plastic repairs of controlled carcinoma cases

ST JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN Oral surgery

Tuesday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery, treatment of injuries to the face

Wednesday Afternoon

MOUNT SINAI HOSPITAL

E. AISON and associates Oral surgery

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations

Thursday Morning

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER Demonstration of cases showing carcinoma of mouth, lips and face, with colored photographs of lesions before and after radiation

MICHAEL REESE HOSPITAL

CASPER EPSTEIN Oral surgery

ST JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN Oral surgery

Thursday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Dry clinic

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL

L. W. SCHULTZ Dry clinic and demonstration

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations

RESEARCH AND EDUCATIONAL HOSPITALS

L. W. SCHULTZ Oral surgery with particular reference to cleft palates and harelips

Day to be Announced

COOK COUNTY HOSPITAL

I. MUSKAT Plastic surgery of the nose and face

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

H. C. VOZIS and J. J. KEARNS: Intracranial injury—demonstration of pathology, physiology, management, surgical interference, sequelae, complications.

Tuesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

- GEZA DE TAKATS: Operation: Lumbar sympathectomy. Symposium: Neurocirculatory Diseases.
- R. BRENNER: The use of neosynephrine in spinal anesthesia.
- WILLIAM C. BECK: Selection of cases for sympathectomy demonstration of sympathectomized patients: evaluation of results, the management of lymphedema.
- F. K. HICK: Vascular accidents associated with coronary occlusion.
- H. C. LUTHE: Unusual reactions following the use of nitroglucose.
- GEZA DE TAKATS: The treatment of acute arterial occlusion: operability of hyperten. on demonstration of cases.
- H. L. MISKIN and P. J. SARMA: The treatment of varicose veins and ulcers.
- J. T. REYNOLDS: Amputations in peripheral vascular disease.

Tuesday Afternoon

MERCY HOSPITAL

- C. F. SCHAECH and H. C. VOZIS: Neuro-ophthalmology. Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problem, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL

A. VERBURGHEN: Dry clinic and demonstration.

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG: Operations and demonstration of cases.

Wednesday Afternoon

COOK COUNTY HOSPITAL

A. VERBURGHEN: Surgical paraplegia—etiology, pathophysiology, diagnosis, physical treatment, prognosis.

PRESBYTERIAN HOSPITAL

A. VERBURGHEN: Operation.

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

P. C. BRYCE and R. B. CLOWARD: Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis.

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG: Operations and demonstration of cases.

Thursday Afternoon

MERCY HOSPITAL

- H. C. VOZIS and associates: Symposium: Management of cerebral glioma.
- H. C. VOZIS and H. E. LARSEN: Demonstration of cerebral plexus resection in hydrocephalus: cytometric studies in neuroglial lesions.
- C. F. SCHAECH and H. C. VOZIS: Neuro-ophthalmology. Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problem, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL

A. VERBURGHEN: Operation.

MICHAEL REESE HOSPITAL

Symposium: Intracranial Septation.

POY GRINER: Neurological aspects of intracranial septation.

A. VERBURGHEN: Surgical aspects of brain abscess.

Friday Afternoon

PASSAVANT MEMORIAL HOSPITAL

LOYAL DAVIS and JOHN MARTIN: Neurological surgery. Presentation emphasizing diagnosis and treatment.

PRESBYTERIAN HOSPITAL

A. VERBURGHEN: Operation.

THORACIC SURGERY

Monday Afternoon

ST LUKE'S HOSPITAL

WILLARD VAN HAZEL: Demonstration clinic.

PAUL H. HOLLINGER: Surgery of bronchus.

Tuesday Morning

COLUMBUS HOSPITAL

R. M. DAVISON, C. VOLINI, M. JOANNIDES, D. ORTH and G. MUELLER: Symposium in tuberculosis: Thoracic surgery, pneumothorax treatment including climatic therapy.

COOK COUNTY HOSPITAL

JOHN B. O'DONOGHUE and ROBERT LEE: Treatment of emphysema: ward walk and presentation of cases.

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL: Operations with demonstration of cases.

ST JOSEPH'S HOSPITAL

WILLIAM C. BECK: Thoracic surgery.

VETERANS ADMINISTRATION FACILITY

JEROME R. HEAD: New type of thoracoplasty—chest surgery.

Tuesday Afternoon

COOK COUNTY HOSPITAL

RALPH B. BETTMAN: Operations.

PRESBYTERIAN HOSPITAL

JOHN DORSEY: Dry clinic and demonstration.

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S LEVINTSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H HOLINGER Bronchogenic aspects

WILLARD VAN HAZEL Surgical consideration, demonstration of cases and specimens, surgical treatment of mediastinal tumors

T J WACHOWSKI Roentgenological consideration of mediastinal tumors

M JOANNIDES Collapse therapy of pulmonary tuberculosis

Wednesday Morning

EVANSTON HOSPITAL

JEROME R HEAD Indications for lobectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON Thoracoplasty

ST BERNARD'S HOSPITAL

R J DRIVER The rational treatment of empyema, demonstration of cases

S L GOVERNALE and F F FIORE Congenital cyst of the lung, demonstration of cases

Wednesday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM

M JOANNIDES Phrenic surgery, intrapleural pneumolysis

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

Thursday Morning

ILLINOIS MASONIC HOSPITAL

MINAS JOANNIDES Phrenic neurectomy, phrenic crush, scalenotomy, artificial pneumoperitoneum, eleuthorax Dry Clinic Eleuthorax Indications, technique and complications, advantages of artificial pneumoperitoneum as an adjunct to phrenic neurectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON Thoracoplasty, pneumolysis

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery

Thursday Afternoon

COOK COUNTY HOSPITAL

RALPH B BETTMAN Operations

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracic surgery

ST BERNARD'S HOSPITAL

A H MONTGOMERY and R E CUMMINGS Pericarditis with effusion, demonstration of case

Friday Morning

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracoplasty operation

MAX BIESSENTIAL Surgery of pulmonary tuberculosis

MAX BIESSENTIAL and RALPH B BETTMAN Technique of various operations used for pulmonary tuberculosis Artificial pneumothorax, pneumolysis, thoracoplasty, motion picture and diagrammatic demonstrations

RALPH B BETTMAN Treatment of empyema, injuries of the chest, presentation of cases, motion picture and diagrammatic demonstrations

WOMEN AND CHILDREN'S HOSPITAL

HELEN HAYDEN, EMELIA GIKIOTAS, MARGARET AUSTIN and NORA B BRANDENBURG Bronchoscopy in relation to asthma and allied pulmonary conditions, lipiodol injection

Friday Afternoon

COOK COUNTY HOSPITAL

JOHN B O'DONOGHUE, FREDERICK TICE, RICHARD JAFFE, M J HUBENY, S H ROSENBLUM and A J HUBENY Symposium Pulmonary tuberculosis

JOHN B O'DONOGHUE Operations

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

TUMORS AND IRRADIATION

Monday Afternoon

ST ELIZABETH'S HOSPITAL

J BRAM Radium treatment of fractures

VETERANS ADMINISTRATION FACILITY

G R ALLABY Regular tumor clinic

Tuesday Morning

LUTHILAN DEACONESS HOSPITAL

ISADORE PILOT Pathology of malignant growths in relation to therapeutic indications

MICHAEL REESE HOSPITAL

MAX CUTLER JEROME F STRAUSS and SAMUEL PEARLMAN Radium therapy in malignant tumors of the head and neck, demonstration of cases and technique

ST ELIZABETH'S HOSPITAL

M G LUGEN Sarcoma of the stomach

VETERANS ADMINISTRATION FACILITY

A E WILLIAMS Deep x ray and radium therapy

Tuesday Afternoon

RAVENSWOOD HOSPITAL

C BUSWELL, J J MOORE, H F SAUNDERS and L E SCHAEFFER Cancer clinic presentation of specimens, lantern slides, cases illustrating melanomas of shoulder and jaw

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S LEVINTSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H HOLINGER Bronchogenic aspects

WILLARD VAN HAZEL Surgical consideration, demonstration of cases and specimens, surgical treatment of mediastinal tumors

- M JOANNIDES Collapse therapy of pulmonary tuberculosis
T J WACHOWSKI Roentgenological consideration of mediastinal tumors

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Tumor Surgery

- A BRUNSCHWIG Experimental production of tumors and the efficacy of Coley's toxin in the treatment of experimental sarcoma palliative treatment of pulmonary metastases from malignant tumors late results in treatment of benign giant cell tumors of bone
D B PHENISTER and associates Studies in the etiology, diagnosis and treatment of bone tumors
HARWELL WILSON Extraskelatal ossifying tumors.

VETERANS ADMINISTRATION FACILITY

- MAX CUTLER Annual tumor clinic Presentation of cancer cases indications technique and results of radium therapy
G R ALLABEN Diagnosis and treatment.

Thursday Morning

COLUMBUS HOSPITAL

- D A ORTH M HANAN and H F DAVIS Symposium Breast cancer

LUTHERAN DEACONESS HOSPITAL

- ISADORE PILOT Pathology of malignant growths in relation to therapeutic indications

MERCY HOSPITAL

- W J PICKETT Unusual cases of malignancy

MICHAEL REESE HOSPITAL

- MAX CUTLER and staff Results of radiation treatment of cancer of mouth tonsil pharynx and larynx, presentation of cases Radiation treatment of cancer of the breast presentation of cases Motion pictures illustrating the technique of radium treatment of cancer of the mouth and cancer of the cervix Transillumination of the breast.

ST ELIZABETH'S HOSPITAL

- LEO M ZUCKERMAN Mediastinal tumors

VETERANS ADMINISTRATION FACILITY

- A E WILLIAMS Inspection of deep x ray and radium therapy unit

WESLEY MEMORIAL HOSPITAL

- GUY S VAN ALSTYNE. Carcinoma of the breast, combined surgical and x ray treatment.

Thursday Afternoon

PASSAUNT MEMORIAL HOSPITAL

- MAX CUTLER. The organization of a tumor clinic Personnel equipment records follow up

Carcinoma of the Breast

- JOHN A WOLFER. Surgical considerations.
JAMES T CASE Pre and postoperative x ray radiation
L M ROSENTHAL. Radium treatment.
MAJOR GREENE Bronchiogenic tumors of the neck
JOHN F DELPER and EARL BARTH Carcinoma of the larynx hypopharynx and tonsil.
JOHN MOHARDT A survey of some proposed cancer cures

Friday Morning

MERCY HOSPITAL

- HENRY L SCHWARTZ and associates Symposium Radiologic therapy of malignancy

RESEARCH AND EDUCATIONAL HOSPITALS

- R B MALCOLM. Operations Neck dissection carcinoma of breast surgical pathology of breast tumors.
T J WACHOWSKI X ray treatment of carcinoma of breast
ARRIE BAMBERGER Ewing tumor with case report.

ST BERNARD'S HOSPITAL

- CHESTER C GUY Surgical pathology of bone tumors

ST LUKE'S HOSPITAL

- H E MOCK and associates Tumor clinic.

VETERANS ADMINISTRATION FACILITY

- G R ALLABEN Regular tumor clinic

WESLEY MEMORIAL HOSPITAL

- EARL LATIMER. Unusual breast tumors.

Friday Afternoon

PRESBYTERIAN HOSPITAL

- CARL APPELBACH and F SQUIRE Dry clinic

Day to be Announced

HENROTIN HOSPITAL

- SAMUEL LEVINSON. Surgical pathology

ROENTGENOLOGY

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

- RALPH WILLY Newer concepts in the treatment of carcinoma

ST MARY OF NAZARETH HOSPITAL

- C J CHALLENGER X ray studies of surgical conditions

Tuesday Afternoon

ST ANTHONY DE PADUA HOSPITAL

- L S TIGHE Silicosis demonstration

ST BERNARD'S HOSPITAL

- B C CUSWEY R J MAIER and E K LEWIS Roentgen therapy of inflammation and infections of the face and neck

ST LUKE'S HOSPITAL

- STAFF X ray diagnosis.

Wednesday Afternoon

AUGUSTANA HOSPITAL

- DAVID S BEILEY Roentgen diagnosis of gastro-intestinal lesions

ALBERT MERRITT BILLINGS HOSPITAL

- PAUL C HODGES and associates X ray diagnosis

Thursday Morning

LUTHERAN DEACONESS HOSPITAL

- RALPH WILLY Newer concepts in the treatment of carcinoma

RESEARCH AND EDUCATIONAL HOSPITALS

ADOLPH HARTUNG Conference on x ray diagnosis, with particular reference to bone dystrophy, lesions of the urinary tract, brain tumors and unusual lesions of the gastro intestinal tract

Thursday Afternoon

COOK COUNTY HOSPITAL

ROBERT F McNATTIN High voltage therapy of malignancies

M J HUBENY Roentgenological examination of appendix

MOUNT SINAI HOSPITAL

MAX COHEN, G DANIELUS and E LEWIN Demonstrations of interesting radiologicosurgical conditions

ST LUKE'S HOSPITAL

STAFF X ray diagnosis

Friday Afternoon

AUGUSTANA HOSPITAL

DAVID S BEILEY Poentgen diagnosis of lesions of urinary tract

COOK COUNTY HOSPITAL

J PAUL BENNETT Roentgenological examination of the kidneys, ureters and bladder

ROBERT F McNATTIN High voltage therapy of malignancies

Days to be Announced

HENROTIN HOSPITAL

ARTHUR R HANSEN X ray demonstration

WESLEY MEMORIAL HOSPITAL

FRANK L HUSSEY The interpretation of x ray findings in obscure gastric and duodenal lesions, the use of x ray in conjunction with surgery of the large bowel

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL

DISRAELI KOBAK Discussion of general physical therapy procedures

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

JOHN S COULTER and S L OSBORNE Clinical and experimental investigations of short wave medical diathermy

MICHAEL REESE HOSPITAL

C O MOLANDER Ward walks, physiotherapy methods

Tuesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in posttraumatic conditions

MUNICIPAL TUBERCULOSIS SANITARIUM

JOHN S COULTER and LEO HARDT Ultraviolet radiation in the treatment of gastro intestinal tuberculosis

Tuesday Afternoon

COOK COUNTY HOSPITAL

I F HUMPHRY Physical therapy in infantile paralysis

MICHAEL REESE HOSPITAL

S PERLOW and C O MOLANDER Physical therapy in the treatment of circulatory disturbances

ST LUKE'S HOSPITAL

GEORGE TAKATS and JOHN S COULTER Physical agents in the treatment of peripheral circulatory diseases. Constant temperature cradle, suction pressure apparatus, intermittent venous hyperemia, oscillating bed, mecholyl iontophoresis.

Wednesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in postoperative and traumatic infections

GARFIELD PARK HOSPITAL

MILTON SCHMITT Hyperpyrexia in gonorrheal arthritis

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

HERMAN CHOR Rationale of physical therapy in muscle disorders

JOHN S COULTER Demonstration of clinical and experimental results

MICHAEL REESE HOSPITAL

FRANK GLASSMAN and C O MOLANDER Physical therapy in the treatment of fractures

Wednesday Afternoon

COOK COUNTY HOSPITAL

I F HUMPHRY Physical therapy in neurosurgical and neurological conditions

GARFIELD PARK COMMUNITY HOSPITAL

MILTON G SCHMITT The value of heating tissues by induction, hyperpyrexia

PASSAVANT MEMORIAL HOSPITAL

J S COULTER Physical therapy in fractures

SUMNER L KOCH, MICHAEL L MASON and J S COULTER Physical therapy in hand injuries

MICHAEL REESE HOSPITAL

I WOLIN and C O MOLANDER Physical therapy in the treatment of poliomyelitis

SIDNEY SIDEMAN and C O MOLANDER Physical therapy in treatment of spastics

Thursday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in low back conditions

ILLINOIS CENTRAL HOSPITAL

JOHN S COULTER Under water exercises in the treatment of fractures of weight bearing bones

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J S COULTER and S L OSBORNE Hyperpyrexia in chronic infectious arthritis

F CHANDLER, J R NORCROSS and J S COULTER Management of low back conditions

MICHAEL REESE HOSPITAL

BERT FINNE Hyperpyrexia in the treatment of gonorrheal arthritis

Thursday Afternoon

COOK COUNTY HOSPITAL

I F HUMMON Manipulative treatment in low back conditions

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

EMIL HALSER and J S COULTER The role of physical therapy in common disorders of the foot

MICHAEL REESE HOSPITAL

JULIUS GRINKER and C O MOLANDER Physical therapy in treatment of peripheral nerve injuries

Friday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in bursitis

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J S COULTER Physical therapy in traumatic arthritis

MICHAEL REESE HOSPITAL

LESTER FRANKENTHAL and C O MOLANDER Physical therapy in treatment of chronic pelvic inflammation

Friday Afternoon

COOK COUNTY HOSPITAL

I F HUMMON Physical therapy in the prevention of deformities

ST LUKE'S HOSPITAL

H E MOCK and JOHN S COULTER Reconstructive cases in physical therapy

EXPERIMENTAL SURGERY

Friday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

LEON ARIES Acceleration of bone growth and repair as determined by deposition of dye in the callus (By feeding dogs dyes which are deposited in the callus experimental fractures are studied to determine what substances accelerate bone growth and repair) Lantern slide demonstration

R A BUSSABARGER S FREEMAN and A C IVY The role of the stomach in calcification of bone (Demonstration of gastrectomized puppies showing homogenous osteoporosis This demonstration shows the necessity of observance of dietary care in gastrectomized patients) Lantern slide demonstration

ELMER J KOEHL The effect of various foods upon bile secretion with and without return of bile to the gastro intestinal tract (Demonstration of animals This shows the necessity of adequate dietary control of patients with biliary fistulas)

C R SCHMIDT and J M BEAZELL The effect of diet on pancreatic secretion (The results obtained guide the postoperative care of a patient with duodenal fistula)

WILLIAM BACHRACH and SAMUEL J FOGELSON Common duct transplantation (Demonstration of animal Results obtained show the site of implantation of the common duct is important in preventing subsequent ascending infections of the biliary passages)

MICHAEL L MASON and HARVEY S ALLEN Experimental studies on tendon repair (Histologic studies of tendon

repair after use of varied suture material grafts and different techniques)

LEO M ZIMMERMAN Surgical repair of inguinal hernia as guided by anatomical studies (A simplification of surgical technique for the treatment of inguinal hernia after evaluating the anatomy)

JOHN MARTIN The negative effects of midbrain lesions upon the gastric secretion motility and gastro intestinal ulceration in monkeys and cats A Horsley Clarke apparatus was used to produce midbrain lesions in cats and monkeys No changes were observed in gastro intestinal function and activity

H CHOR The rational of physical therapy in the treatment of muscle disorders Experimental observations on massage passive movement of electrical stimulation and of rest upon muscle atrophy and regeneration in the lower motor neuron type of paralysis

MICHAEL REESE HOSPITAL

STAFF Demonstration in experimental surgery

Days to be Announced

ALBERT MEKRITT BILLINGS HOSPITAL

LABORATORY STAFF Demonstration in experimental surgery

RESEARCH AND EDUCATIONAL HOSPITALS

WARREN H COLE and associates Period of experimental surgery

OPHTHALMOLOGY

Monday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

A C KRAUSE Fundus diagnosis

CHILDREN'S MEMORIAL HOSPITAL

G GUIBOR Orthoptics

COOK COUNTY HOSPITAL

E B FOWLER Fundus diagnostic clinic

ILLINOIS EYE AND EAR INFIRMARY

R VON DER HEYDT Operation for glaucoma and cataract
DWIGHT C ORCLITT Dry clinic

MERCY HOSPITAL

C F SCHAUB F I BARNETT and E A ROLING Fundus clinic

MICHAEL REESE HOSPITAL

PHILIP HALPER Orthoptics

RUSH MEDICAL COLLEGE

DR HOLMES Orthoptics

Tuesday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

GEORGE GUTHOR Orthoptic training, classification of squint

SANFORD R GIFFORD Concomitant and paralytic squint

RUSH MEDICAL COLLEGE

DR WILBER Histopathology

Tuesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

C V DEVNEY Orthoptics

COLUMBUS HOSPITAL

M GOLDENBURG Eye clinic

COOK COUNTY HOSPITAL

C F BERGER Medical ophthalmology

ILLINOIS EYE AND EAR INFIRMARY

THOMAS D ALLEN Operation for glaucoma and cataract

LOUIS HOFFMAN and E K FINDLAY Dry clinics

MERCY HOSPITAL

C F SCHAUB and H C VORIS Neuro ophthalmology
Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

MOUNT SINAI HOSPITAL

J LEBENSOHN and E SELINGER Clinic

MICHAEL REESE HOSPITAL

T M SHAPIRA Fundus clinic

RUSH MEDICAL COLLEGE

DR JACOBSON Fundus clinic

ST LUKE'S HOSPITAL

F A VORISEK Clinical cases

Wednesday Morning

COOK COUNTY HOSPITAL

SANFORD R GIFFORD Retinal detachment

RUSH MEDICAL COLLEGE

W F MONCREIFF Cataract

Wednesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

S S BLANKSTEIN End results of retinal detachment operations

CHILDREN'S MEMORIAL HOSPITAL

R C GAMBLE and E A VORISEK Diagnostic clinic

ILLINOIS EYE AND EAR INFIRMARY

DWIGHT C ORCUTT Operation for glaucoma and cataract

S J MEYER Retinal detachment

K H CHAPMAN Orthoptics

MERCY HOSPITAL

C F SCHAUB, F I BARNETT and E A ROLING Fundus clinic

MICHAEL REESE HOSPITAL

S J MEYER and D SNYDER Retinal detachment clinic

ST LUKE'S HOSPITAL

J WALSH Clinical cases

U S MARINE HOSPITAL

ALFRED N MURRAY Eye injuries

Thursday Morning

ILLINOIS MASONIC HOSPITAL

ALVA SOWERS Cataract extraction employing Elschnig technique, discussion of dinitrophenol cataracts—treatment results

Thursday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

L BOTHMAN Macular disease

COLUMBUS HOSPITAL

M GOLDENBURG Eye clinic

COOK COUNTY HOSPITAL

E B FOWLER Fundus clinic

ILLINOIS EYE AND EAR INFIRMARY

E A FINDLAY and LOUIS HOFFMAN Operation for glaucoma and cataract

THOMAS D ALLEN Glaucoma

MERCY HOSPITAL

C F SCHAUB and H C VORIS Neuro ophthalmology
Presentation of cases with fundi, perimetric field findings, diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

MICHAEL REESE HOSPITAL

JACK COWAN Glaucoma clinic

ST LUKE'S HOSPITAL

FRANK E BRAWLEY and J W CLARK Clinical cases

Friday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

DR McSHELLMAN Cataract results

CHILDREN'S MEMORIAL HOSPITAL

R O RISER Diagnostic clinic

ILLINOIS EYE AND EAR INFIRMARY

S J MEYER Operation for glaucoma and cataract

R VON DER HEYDT Slit lamp demonstration

RUSH MEDICAL COLLEGE

E SELINGER Medical ophthalmology

ST LUKE'S HOSPITAL

R C GAMBLE Clinical cases

Days to be announced

COLUMBUS HOSPITAL

M GOLDENBURG Glaucoma clinic

HENROTIN HOSPITAL

GEORGE W MAHONEY, E A ROLING and IRVING BARNETT Eye clinic

OTOLARYNGOLOGY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER SIDNEY POLLACK and BERNARD M. COHEN Plastic surgery of the nose nasal fractures, nasal and ear prostheses

RESEARCH AND EDUCATIONAL HOSPITALS

OLIVER E. VAN ALVEA Surgical anatomy of the nasal sinuses

MANUEL G. SPIESMAN Diseases of the pharynx

SYLVIO A. SALARETTA Conservative treatment of chronic suppurative otitis media

RUSH MEDICAL COLLEGE

LOUIS T. CERRY and FRANK WOJNIAK. Sulfanilamide in the treatment of meningitis

Tuesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK ALFRED LEWY JACOB LIFSCHUTZ S. M. MORWITZ, FRANCIS L. LEDERER, M. R. GUTTMAN and associates Clinics

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME L. STRAUSS and SAMUEL PEARLMAN Radium therapy in malignant tumors of the head and neck demonstration of cases and technique

ST. JOSEPH'S HOSPITAL

AUSTIN A. HAYDEN Conservation of hearing, mastoid and sinus surgery

Tuesday Afternoon

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery treatment of injuries to the face

RESEARCH AND EDUCATIONAL HOSPITALS

FRANCIS LEDERER Ear, nose and throat plastic surgery
PAUL H. HOLINGER Diseases of the larynx

RUSH MEDICAL COLLEGE

ELMER Hagens and PAUL CAMPBELL Pathology of the petrous bone in cases dying of meningitis lantern slides.

ST. MARY OF NAZARETH HOSPITAL

J. J. KILLEEN Mastoiditis in children

Wednesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK ALFRED LEWY JACOB LIFSCHUTZ S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates Clinics

ST. ELIZABETH'S HOSPITAL

F. A. DULAK Ozena

Wednesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

J. THEOBALD Complications of middle ear infections

SHEEMAN L. SHAPIRO Neuro-otology

DR. PELOUZE Deep neck infections

RUSH MEDICAL COLLEGE

THOMAS W. LEWIS and RICHARD WATKINS Causative factors and results of treatment of vasomotor rhinitis with foreign protein

ST. ANNE'S HOSPITAL

JERRY HAYDEN Ear, nose and throat clinic

HARRY M. PETERSON Surgical demonstration and clinic

Thursday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK ALFRED LEWY JACOB LIFSCHUTZ S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates Clinics

ST. JOSEPH'S HOSPITAL

AUSTIN A. HAYDEN Conservation of hearing mastoid and sinus surgery

Thursday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

NATHAN H. FOX and JOHN W. HARNED, Jr. Rhinologic surgery allergy in relation to otolaryngology

FRANCIS LEDERER and N. T. PATTENGALL Cancer of the ear, nose and throat

RUSH MEDICAL COLLEGE

GEORGE L. SHAMBAUGH, JR. and LINTON WALLNER The treatment of deafness

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

JOHN M. BICK Submucous resection and tonsillectomy

MOUNT SINAI HOSPITAL

JOSEPH C. BECK ALFRED LEWY JACOB LIFSCHUTZ, S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates Clinics

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

A. R. HOLLENDER Physical therapeutic methods

W. THEOBALD Nasal accessory sinus disease

PAUL H. HOLINGER Bronchoscopy and esophagoscopy

RUSH MEDICAL COLLEGE

DANIEL B. HAYDEN and E. L. CHAINSKI Conditions producing tinnitus evaluation of methods of treatment

Days to be Announced

BILLINGS MEMORIAL HOSPITAL

J. R. LINDSAY Petrositis, septic otitis and lateral sinus thrombosis

CHILDREN'S MEMORIAL HOSPITAL

GEORGE LIVINGSTON, PAUL HOLINGER and associates Intracranial complications of ear infections bronchoscopy in children endoscopic cases

COOK COUNTY HOSPITAL

I. MUSKAT Plastic surgery of the nose and face

S. PEARLMAN Diseases of the neck and larynx including laryngoscopy and bronchoscopy

L. CURRY Mastoiditis and meningitis

A. LEWY The mastoid and the labyrinth

T. C. GALLOWAY and H. E. DAVIS Selective treatment in malignancy about the head

ILLINOIS EYE AND EAR INFIRMARY

ALFRED LEWY Chronic suppurative otitis media

JOHN CAVANAUGH Chronic sinusitis diagnosis and surgical treatment

OTOLARYNGOLOGY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER SIDNEY POLLACK and BERNARD M COHEN Plastic surgery of the nose nasal fractures nasal and ear prostheses.

RESEARCH AND EDUCATIONAL HOSPITALS

OLIVER E VAN ALVEA Surgical anatomy of the nasal sinuses

MANUEL G SPIESMAN Diseases of the pharynx

SYLVIO A SCIARETTA Conservative treatment of chronic suppurative otitis media

RUSH MEDICAL COLLEGE

LOUIS T CERRY and FRANK WOJNIAK Sulfanilamide in the treatment of meningitis

Tuesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M MORWITZ FRANCIS L LEDERER M R GUTTMAN and associates Clinics

MICHAEL REESE HOSPITAL

MAX CUTLER JEROME E STRAUSS and SAMUEL PEARLMAN Radium therapy in malignant tumors of the head and neck demonstration of cases and technique

ST JOSEPH'S HOSPITAL

AUSTIN A HAYDEN Conservation of hearing mastoid and sinus surgery

Tuesday Afternoon

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery treatment of injuries to the face

RESEARCH AND EDUCATIONAL HOSPITALS

FRANCIS LEDERER Ear nose and throat plastic surgery
PAUL H HOLINGER Diseases of the larynx

RUSH MEDICAL COLLEGE

ELMER HAGENS and PAUL CAMPBELL Pathology of the petrous bone in cases dying of meningitis lantern slides

ST MARY OF NAZARETH HOSPITAL

J J KELLEN Mastoiditis in children

Wednesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M MORWITZ FRANCIS LEDERER M R GUTTMAN and associates Clinics

ST ELIZABETH'S HOSPITAL

F A DULAX Ozena

Wednesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

J THEOBALD Complications of middle ear infections
SHERMAN L SHAPIRO Neuro-otology
DR. PELOUCE Deep neck infections.

RUSH MEDICAL COLLEGE

THOMAS W LEWIS and RICHARD WATKINS Causative factors and results of treatment of vasomotor rhinitis with foreign protein.

ST ANNE'S HOSPITAL

JERRY HAYDEN Ear nose and throat clinic.

HARRY M PETERSON Surgical demonstration and clinic.

Thursday Morning

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M MORWITZ FRANCIS LEDERER M R GUTTMAN and associates Clinics

ST JOSEPH'S HOSPITAL

AUSTIN A HAYDEN Conservation of hearing mastoid and sinus surgery

Thursday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

NATHAN H FOX and JOHN W HARNED JR. Rhinologic surgery allergy in relation to otolaryngology

FRANCIS LEDERER and A T PATTERNGALE Cancer of the ear nose and throat

RUSH MEDICAL COLLEGE

GEORGE E SHAMBAUGH JR and LINTON WALLNER The treatment of deafness

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

JOHN M BICK Submucous resection and tonsillectomy

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M MORWITZ FRANCIS LEDERER M R GUTTMAN and associates Clinics

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

A R HOLLENDER Physical therapeutic methods.

W THEOBALD Nasal accessory sinus disease

PAUL H HOLINGER Bronchoscopy and esophagoscopy

RUSH MEDICAL COLLEGE

DANIEL B HAYDEN and E L CRAIG Conditions producing tinnitus evaluation of methods of treatment.

Days to be Announced

BILLINGS MEMORIAL HOSPITAL

J R LINDSAY Petrositis septic otitis and lateral sinus thrombosis

CHILDREN'S MEMORIAL HOSPITAL

GEORGE LIVINGSTON PAUL HOLINGER and associates Intracranial complications of ear infections bronchoscopy in children endoscopic cases

COOK COUNTY HOSPITAL

I MUSKAT Plastic surgery of the nose and face.

S PEARLMAN Diseases of the neck and larynx including laryngoscopy and bronchoscopy

L CERRY Mastoiditis and meningitis.

A LEWY The mastoid and the labyrinth.

T C GALLOWAY and H E DAVIS Selective treatment in malignancy about the head

ILLINOIS EYE AND EAR INFIRMARY

ALFRED LEWY Chronic suppurative otitis media.

JOHN CAVANAUGH Chronic sinusitis diagnosis and surgical treatment.

SURGERY

GYNECOLOGY AND OBSTETRICS

An International Magazine, Published Monthly

VOLUME 65

SEPTEMBER, 1937

NUMBER 3

RECURRING MYXOMATOUS, CUTANEOUS CYSTS OF THE FINGERS AND TOES

ROBERT L. GROSS, M.D., Boston, Massachusetts

MYXOMATOUS, cutaneous cysts or so called "synovial lesions of the skin" have received little attention in medical literature. The scarcity of adequate descriptions of the condition and the unusual experience of excising one of these innocuous looking cysts of the finger only to have it recur after multiple removals have led to the following study. A cutaneous condition such as is here described might seem to be primarily of dermatological interest, but since these peculiar cysts are usually extirpated by surgeons who have the embarrassment of seeing them recur repeatedly, it is appropriate to present this material in a surgical journal. My attention was called to the subject by Prof. S. B. Wolbach who first encountered such a lesion (Case 1) in 1928, the findings in this instance being unique in his extensive knowledge of pathological material. This original observation and the subsequent study of 7 additional examples form the basis of the present report.

These thin walled cysts, filled with a colorless, gelatinous, viscid fluid and occurring on the dorsal aspects of the fingers or toes arrest the attention on two accounts. First, they are extremely refractory to surgical treatment,

but can usually be cured by radium or x-ray irradiation. Second, their pathogenesis is puzzling and the cause for the myxomatous degeneration of the derma which gives rise to the cyst formation is as yet unexplained.

Interest was initially directed to the condition by Hyde in 1883, who in a later edition of his *Diseases of the Skin* in 1897 gave credit for the original description to Jones and Markins of St. Thomas' Hospital, London, when they exhibited several specimens before the London Pathological Society. Succeeding accounts were usually made in the form of presentation of cases for diagnosis at dermatological societies. The total number of reports in the literature is small and only 14 could be accepted and used for analysis, the data of which appear in Table I. The lesion is obviously rare, yet the finding of the last 5 cases herein reported within a period of 2 months makes it probable that the condition is more common than was formerly suspected.

CLINICAL FINDINGS

The cysts are usually about the size of a pea, though they may vary considerably in overall dimensions. The smallest one in the present series (Case 7) was 5 millimeters in diameter and 3 millimeters high, while the largest ones (Cases 6 and 8) were each 12 millimeters in

I from the Surgical and Pathological Services of the Peter Bent Brigham Hospital and the Harvard Medical School

greatest length. Inspection shows these swellings to be smoothly rounded, thin walled structures which often can be transilluminated. Occasionally, the wall is thin enough so that the lesion has a vesicular appearance. The color is that of normal skin, but there may be a faint yellowish or bluish cast. The skin surrounding the base of a cyst does not show any increased vascularity unless there has been a superimposed secondary infection. External pressure will not reduce the size of the mass for the cyst cavity does not communicate with a joint bursa, or tendon sheath. *Tenderness is usually mild or absent.*

In all of the 14 cases gathered from the literature and in 7 of the examples here recorded a finger was involved by the lesion, but in 1 of our patients (Case 2) the same condition was found on a toe. In 15 cases in which information is available, the right hand was involved in 12 and the left in 3. The number of lesions appearing on the various fingers was as follows: thumb, 2; index finger, 6; middle finger 9; ring finger, 0; little finger, 1. The toe involved in our second case was the right middle one. Such a cyst is found only on the dorsal surface of the digit, usually in proximity to a joint which most often is the distal interphalangeal articulation. When found in the neighborhood of a joint, it is likely to be situated a little to one side of the midline of the digit (Fig 1 frontispece), but if it is situated some distance from a joint, it may be in the midline (Fig 17).

The condition is not distributed equally between the two sexes, for 75 per cent of the patients were women. The youngest age at which the lesion has been described was 26 years and the oldest was 66 years, the average being 48 years.

The clinical history reveals that these cysts have usually been present for considerable periods of time varying from several months to a few years, the average being about 9 months. The patient frequently states that the cyst has been pricked open on several occasions, believing the vesicle to be of little consequence. When this drainage has been done the fluid thus released is always described as being clear and colorless and having a syrupy consistency. In every instance the

individual was surprised to find that such drainage gave only temporary relief and was followed by prompt recurrence in two to four weeks' time.

PATHOLOGY

The benign appearance of these lesions and the slight attention which is paid to them in their early stages makes it impossible to study specimens showing the first changes, for these are seldom surgically removed. Recurrent lesions, however, have been excised fairly soon after their reappearance so that this material can be utilized for observing the changes which take place prior to actual cyst formation. The completely formed cysts have been occasionally examined histologically and the findings in this stage are more familiar. The following description represents the pathological changes as far as we have been able to study them.

The first variation from the normal appears to be a degeneration or resorption of the collagen in a localized but poorly limited area of the derma (Figs 4 and 5). The fibroblasts remain as a sort of skeleton framework with but little intercellular material. These connective tissue cells apparently persist in a fairly good state of preservation for a long time, at least they show degeneration much more slowly than does the collagen. Between the separated cells there then collects a faintly staining, basophilic, mucoid material which gradually increases in amount (Fig 3) and the cell processes and fibrils become widely separated so that the tissue has a very loose texture. As these changes proceed, the widely spaced fibroblasts gradually disintegrate and multiple minute cavities appear (Fig 6). These gradually increase in number and size and finally coalesce so that a cyst forms which is grossly visible and which contains a clear and glairy fluid of gelatinous or syrupy consistency. Thus in the earliest formed cysts the walls have a loose textured and myxomatous structure and may be irregular or jagged (Fig 2). If the cyst is left undisturbed for a considerable period of time (possibly several months or more) its inner wall becomes smoothly rounded more dense, and well defined. When this stage is reached a rather

TABLE I—LIST OF PREVIOUSLY PUBLISHED CASES

Author	Year reported	Age Sex	Digit involved	Size of lesion	Duration of disease	Treatment and results
Lingenfelter	1913	51 F	Dorsal surface over distal interphalangeal joint right middle finger	Pea size	14 mos	Incision—recurred Incision—recurred Curettage—recurred Cauterization with nitric and carbolic acid—recurred CO ₂ snow—recurred Evaporation—recurred Treated with resorcin and salicylic acid crystals—recurred X ray exposures (? dose)—cured
Ormsby	1913	46 F	Dorsal surface distal articulation right middle finger	Larger than a pea	5 mos	Excision—recurred Incision—recurred Incision—recurred Radiotherapy—cured
Ormsby	1913	48 F	Distal phalanx index finger	Pea size	8 mos	Excision—recurred Incision—recurred Radiotherapy and electrolysis—cured
Ormsby	1913	50 F	Over distal articulation of index finger	Larger than a pea	4 mos	Radiotherapy—cured
Ormsby	1913	66 M		Pea size	18 mos	Incision and electrolysis—cure 1
Sutton	1916	58 F	Distal phalanx right middle finger	Pea size	14 mos	Incision—recurred Incision—recurred
Sutton	1916	26 F	Dorsal surface of metacarpophalangeal joint index finger	Pea size	5 mos	Radium treatment—cured
Pussey, quoted by Mackee and Andrews (7)	1921	17	Over distal phalanx right middle finger	Pea size		
Pussey, quoted by Mackee and Andrews (7)	1921	M	Over distal interphalangeal joint right middle finger	Pea size		
Montgomery and Culver	1922					Excision—recurred Curettage—recurred Cauterized with trichloroacetic acid—recurred X ray—cured
Montgomery and Culver	1922					Repeated surgical operations—recurred Radium—cured
Montgomery and Culver	1922		Over distal interphalangeal joint right index finger			
Savatsky (Case 2)	1924	46 F	Dorsal aspect distal interphalangeal joint right fifth finger	Pea size	8 yrs	Cured—? result
Savatsky (Case 3)	1924	26 M	Just below nail of right thumb	4-5 mm in diameter	Few months	Application of phenol—recurred Radium—cured

normal appearing derma abutts directly on the cyst lumen (Figs 7, 13, and 16)

When these lesions have been completely excised and studied for possible connection with a subjacent structure (such as joint cavity, tendon sheath, or bursa) no communication has ever been demonstrated. From this description and from the case reports it may be seen that there is no epithelial or endothelial lining to the cysts (Figs 8, 13, 16). Therefore, the mucoid material which collects in such a cyst is in no way a secretory product but must be regarded as having its origin only from degeneration of the local connective tissue.

One of the unusual cytological features in both the early myxomatous substance and the fully developed cystic lesion is the absence of any appreciable leucocytic infiltration. Wandering cells are rarely seen, and when present are usually of the lymphocytic series and appear in only small numbers. In no case has there been any evidence of hemorrhage, either old or recent, so that local hemorrhage (from trauma, etc.) cannot be regarded as the primary event in the histological changes. The microscopic picture does not suggest that infarction will explain all of the findings. Furthermore, the blood vessels of neighboring

tissues do not show changes with sufficient frequency to regard them as important. Arteritis or other pathology of the vessel walls has not been observed or recorded either in the published cases or in the present series but in one case we found old fibrous thrombi in regional vessels. These thrombi however may have been formed as a result of previous therapeutic procedures.

ETIOLOGY

The pathogenesis of this type of cutaneous cyst is unknown. The condition represents a localized degenerative process in the corium the originating cause of which is very obscure. As was previously pointed out in the section on pathology the connective tissues of the deeper portions of the corium undergo a myxomatous change the collagen gradually disappears and a basic staining mucoid material collects between the remaining fibroblasts. This loose textured substance forms the swelling seen in the earliest lesions and at this stage there is no actual lumen present on gross examination. As the process continues however liquefaction occurs in the central portion of such myxomatous tissue and this hollowing out results in a cavity filled with semi fluid material. There is then no secretory activity concerned in the development of the lesions in other words the fluid found in the cyst is not produced by a mucous membrane lining the cyst wall for such a layer does not exist. In short the cavitation results solely from a focal degeneration of the dermal layer of the skin.

It is difficult to understand why a small area of connective tissue should undergo this spontaneous autolysis. It is even harder to comprehend why it should continue to do so after repeated excisions of the local mass. Only two theories seem worthy of consideration. First local injury may be of some importance for the sites of election (dorsal surfaces of the fingers) are constantly exposed to trauma of varied sorts. Repeated knocks, blows, continued pressure squeezing etc.—usually minor enough to be forgotten—may possibly so alter the derma that degenerative processes are instituted. Second thrombosis of small arterial channels may cause the re-

gional blood supply to vary so that incomplete or partial nourishment produces these changes.

Several authors have expressed the view that these myxomatous lesions might have a derivation from a nearby joint cavity or tendon sheath, yet it is a fact that no one has ever demonstrated such a communication. It has been common experience which is further substantiated by our Cases 1, 2, 3, and 6 that complete excision of the lesion is possible without cutting across a lumen leading to such structures. Furthermore, microscopic examinations of the cysts have not shown any extraneous connections. Therefore the term 'synovial lesions' which some writers have employed in designating these cysts is an improper one and is misleading. In summary the idea that the cyst is an outpocketing of one of the serous membranes of a digit is wholly untenable.

Savatard presented 3 cases of 'Peri Articular Fibroma of the Skin (Synovial Lesion of the Skin)' the first of which was a solid fibroma and was obviously different from the condition under discussion. His second case however appeared to be typical of these synovial lesions and while Savatard believed this to represent a cystic degeneration of a fibroma his description and illustrations cast grave doubt on this view. In his third case biopsy examination was not made, but it was undoubtedly one of the cysts here discussed. This author's material does not lend any justifiable evidence to the view that a myxomatous cyst of the digit may originate from a fibroma.

Nachlas reported a series of 'Cystic Nodules of the Terminal Finger Joints' which may possibly have some relationship to our myxomatous cysts. The nodules which Nachlas described were believed by him to be precursors in the formation of Heberden's nodes of hypertrophic osteo-arthritis. This author did not include any pathological description of his material hence it is impossible to draw analogies or differences in the two conditions yet some of his gross descriptions were strongly reminiscent of the cysts here presented. However, lack of further evidence prohibits the elaboration of this discussion.

TABLE II—LIST OF CASES IN PRESENT SERIES

Case	Age Sex	Digit involved	Size of lesion	Duration of lesion	Treatment and results
1	55 M	Right middle finger distal phalanx base of nail	5 mm diameter	10 mos	1 Opened—recurred 2 Opened—recurred 3 Opened—recurred 4 Opened—recurred 5 Incised—recurred 6 Total excision—recurred 7 Total excision complicated by severe secondary infection—cured
2	54 M	Right middle toe Lateral aspect near distal interphalangeal joint (Fig. 1)	8 mm diameter	1 month	1 Incised—recurred 2 Excised—recurred 3 Aspirated—recurred 4 Toe amputated
3	60 F	Right middle finger over distal interphalangeal joint (Fig. 1 finger and section)	4 mm diameter	2 mos	1 Excised—recurred 2 X ray (600 r)—cured
4	50 F	Left middle finger on terminal phalanx (Fig. 9)	11 mm long 9 mm wide 6 mm high	5 mos	1 Incision—recurred 2 Incision plus x ray (600 r)—cured
5	65 F	Right index finger over terminal interphalangeal joint (Fig. 11)	6 mm diameter	1 yr	1 X ray (600 r) had little effect 2 Cyst incised and evacuated—cured
6	46 F	Right middle finger near distal interphalangeal joint (Fig. 14)	12 mm long 8 mm wide 5 mm high	1 yr	1 Excision—recurred 2 Excision—recurred 3 Incision plus x ray (600 r)—recurred 4 Aspiration plus x ray (600 r)—partial recurrence 5 Total excision—cured
7	46 F	Left index finger on terminal phalanx (Fig. 17)	5 mm diameter 3 mm diameter	9 mos	Excision plus x ray (600 r)—cured
8	40 F	Left thumb on terminal phalanx (Fig. 18)	7 mm long 12 mm wide 5 mm high	3 mos	Incision plus x ray (600 r)—cured

A review of the material shows no evidence of neoplasia. The persistence of these cysts for months or years and the manner in which they recur again and again after excision would at first suggest that there may be some new-growth which recurs locally after extirpation. The findings however are those characteristic of a degenerative and not a neoplastic lesion.

In passing, it must be noted that other parts of the body may possibly have cutaneous lesions such as are here described on the digits. A case in point is that of Letulle and Bazy. This patient, a girl 17 years old, had a "synovial lesion" on the palmar aspect of the wrist which repeatedly recurred after excision and required four operative removals. Histologically, there was a myxomatous type of central degeneration similar to that which we have seen on the fingers and on a toe. Furthermore, there has been a growing opinion for many years that all ganglia such as occur on the back of the hands and wrists do not represent outpocketings of joint or tendon sheath cavities, but some are the result of a collagenous degeneration of the local con-

nective tissue (Clarke). It is possibly this difference of origin of "ganglia" (outpocketings of sheaths and joints as opposed to degeneration of connective tissue) which accounts for the success or failure (30 per cent recurrence) following their surgical removal. We are led to believe that included in those cases which have been classified as "ganglia" there may have been some instances of the pathological process such as is here described as occurring on the digits.

TREATMENT

A review of the cases listed in Tables I and II shows the various forms of treatment which have been tried and the results which have been obtained in each instance. It has been learned empirically that most surgical therapy, including drainage, excision, curettage, and insertion of sclerosing or caustic fluids is without avail, whereas x-ray or radium irradiation in adequate dosage is almost universally successful in producing a permanent cure.

Incision and drainage. Many patients had often voluntarily pricked open the cysts on multiple occasions before seeking professional

tissues do not show changes with sufficient frequency to regard them as important. Arteritis or other pathology of the vessel walls has not been observed or recorded, either in the published cases or in the present series, but, in one case we found old fibrous thrombi in regional vessels. These thrombi however, may have been formed as a result of previous therapeutic procedures.

ETIOLOGY

The pathogenesis of this type of cutaneous cyst is unknown. The condition represents a localized degenerative process in the corium, the originating cause of which is very obscure. As was previously pointed out in the section on pathology, the connective tissues of the deeper portions of the corium undergo a myxomatous change, the collagen gradually disappears and a basic staining mucoid material collects between the remaining fibroblasts. This loose textured substance forms the swelling seen in the earliest lesions, and at this stage there is no actual lumen present on gross examination. As the process continues, however, liquefaction occurs in the central portion of such myxomatous tissue and this hollowing out results in a cavity filled with semi fluid material. There is then, no secretory activity concerned in the development of the lesions. In other words, the fluid found in the cyst is not produced by a mucous membrane lining the cyst wall, for such a layer does not exist. In short the cavitation results solely from a focal degeneration of the dermal layer of the skin.

It is difficult to understand why a small area of connective tissue should undergo this spontaneous autolysis. It is even harder to comprehend why it should continue to do so after repeated excisions of the local mass. Only two theories seem worthy of consideration. First local injury may be of some importance, for the sites of election (dorsal surfaces of the fingers) are constantly exposed to trauma of varied sorts. Repeated knocks, blows, continued pressure, squeezing etc.—usually minor enough to be forgotten—may possibly so alter the derma that degenerative processes are instituted. Second, thrombosis of small arterial channels may cause the re-

gional blood supply to vary so that incomplete or partial nourishment produces these changes.

Several authors have expressed the view that these myxomatous lesions might have a derivation from a nearby joint cavity or tendon sheath, yet it is a fact that no one has ever demonstrated such a communication. It has been common experience, which is further substantiated by our Cases 1, 2, 3, and 6, that complete excision of the lesion is possible without cutting across a lumen leading to such structures. Furthermore, microscopic examinations of the cysts have not shown any extraneous connections. Therefore, the term "synovial lesions" which some writers have employed in designating these cysts is an improper one and is misleading. In summary, the idea that the cyst is an outpocketing of one of the serous membranes of a digit is wholly untenable.

Savatard presented 3 cases of "Peri Articular Fibroma of the Skin (Synovial Lesion of the Skin)" the first of which was a solid fibroma and was obviously different from the condition under discussion. His second case, however appeared to be typical of these "synovial lesions" and while Savatard believed this to represent a cystic degeneration of a fibroma, his description and illustrations cast grave doubt on this view. In his third case biopsy examination was not made, but it was undoubtedly one of the cysts here discussed. This author's material does not lend any justifiable evidence to the view that a myxomatous cyst of the digit may originate from a fibroma.

Nachlas reported a series of "Cystic Nodules of the Terminal Finger Joints" which may possibly have some relationship to our myxomatous cysts. The nodules which Nachlas described were believed by him to be precursors in the formation of Heberden's nodes of hypertrophic osteoarthritis. This author did not include any pathological description of his material, hence it is impossible to draw analogies or differences in the two conditions, yet some of his gross descriptions were strongly reminiscent of the cysts here presented. However, lack of further evidence prohibits the elaboration of this discussion.

x-rays or radium is the treatment of choice. The reports in the literature have practically no discussion regarding the necessary amounts of exposure which are required. Sutton (13, 14) treated 1 patient successfully, apparently using 10 milligrams of unscreened radium, one-half hour daily for 8 doses, making a total dosage of 40 milligram hours. We have employed x-ray therapy in 6 cases using each time 600 r (300 r for 2 doses, 2 days apart). In 5 lesions thus treated there was no recurrence but another patient (Case 6) was given an additional 960 r (480 r in 2 doses, 2 days apart) which reduced the size of the cyst to about one-third of its former volume. The limited experience with x-ray treatment of these cysts makes it probable that further experimenting will be necessary in order to ascertain the dosage which will be effective in all cases. One gains the impression that an intense local reaction must be set up in order to be effective, and that at least an erythema should be produced.

CASE REPORTS¹

CASE 1. C. H. was a 51 year old man who noticed a small bleb about 5 millimeters in diameter at the base of the nail of the right middle finger. He opened this with a pin and expressed some gelatinous material, but the cyst reappeared within several weeks. The patient further opened this structure on 3 occasions during the next 4 months, but following each of these the cyst again reformed. At the end of 5 months it was then incised by a physician and the performance of reappearing was again enacted. Examination (10 months after the origin of the cyst) showed a small, thin walled translucent vesicle about 5 millimeters in diameter lying just at the base of the nail, in the midline of the terminal phalanx.

Under local anesthesia the entire cyst, with a little of the surrounding normal tissue, was excised. In 4 months a similar small cyst had recurred and excision of the lesion was again performed under novocaine anesthesia. A few days after this second operation, the site showed evidence of infection with involvement of the surrounding soft tissues as well as the underlying bone. After great difficulty in treating the osteomyelitis, the finger healed and though the terminal phalanx is slightly deformed from the secondary infection, there is no evidence of recurrence of the cyst 8 years later. (Without doubt the extensive local inflammation played an important role in the healing of this lesion which 5 previous incisions and 1 excision had failed to eradicate.)



Fig. 3. Photomicrograph of recurrent myxomatous lesion of a finger (Case 1) removed at second operation. This tissue shows the change which takes place in the derma preceding cavity formation. The corium, in most of the field, has lost a large portion of its collagen and has a loose textured structure. There is no leucocytic reaction. $\times 40$.

Pathological examination of the first surgical specimen showed it to be an oval shaped piece of skin 8 millimeters long, 5 millimeters wide and 5 millimeters thick. In the middle portion of this, and bulging up on the external surface was a small thin walled structure about 4 millimeters in diameter which when sectioned was found to contain a thick, gelatinous, somewhat stringy material resembling mucus. Microscopically, the cystic area lay wholly within the derma and consisted of an irregular cavity, the walls of which were formed by an edematous connective tissue of very loose texture and which was directly continuous with and merged into the adjacent corium (Fig. 2). It appeared that the derma in this area had undergone a degenerative change, the first phase of which was a resorption of collagen, leaving a loosely woven meshwork of fibroblasts, between the cell processes and fibrils of which were small amounts of some flocculent, basophilic staining material. In the central portion of the lesion degeneration was more marked and had advanced to actual cavitation. There was, then, no epithelial or endothelial lining to the cyst. In the tissues surrounding this cyst there was no apparent change in vascularity, and infiltrating leucocytes were found in only small numbers, those present being mostly lymphocytes. Toward one edge of the cyst was a narrow rim of epidermal cells dipping down and surrounding a part of the loose texture tissue in such a way as to give the impression that the epidermis was attempting to surround and wall off or extrude this abnormal substance.

Pathological examination of the material removed at the second operation showed it to consist of a small piece of skin with a centrally placed light gray soft nodule 2 to 3 millimeters in diameter which lay in the corium and which bulged up the overlying

¹ I am indebted to Dr. Francis Newton, Dr. Harlan Newton, and Dr. David Cheever for their kind permissions to include Cases 1, 2, and 3 respectively.

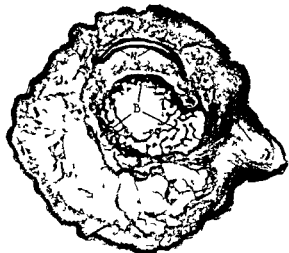


Fig. 4 Photomicrograph of recurrent myxomatous cyst of a toe (Case 2—same specimen as shown in Fig. 1). The illustration includes an entire cross section of the digit which was amputated at the second operation. On the right can be seen the projection from the skin surface, this nodule containing the degeneration in its corium (this entire lesion had been excised 13 months previously). Higher powers of this area are seen in Figures 5 and 6. A Nailbed B bone of phalanx M myxomatous lesion $\times 4$.

epidermis. Histologically portions of this material showed cicatrization and organization which most likely resulted from the previous operative procedure. The greater part of the specimen however again showed a very loose texture, myxomatous type of connective tissue replacing the dermal layer



Fig. 6 Photomicrograph showing higher power detail from the right upper portion of the lesion illustrated in Figure 5. The pathological change is confined to the dermis and is a localized degeneration of this layer. The myxomatous substance toward the left has no evidence of neoplasm. The three zones marked x represent beginning cavitation. $\times 45$.



Fig. 5 Photomicrograph showing higher details of the cutaneous nodule seen on the right side of Figure 4. The area of degeneration in the corium has no well defined borders. There is no communication with underlying structures such as joint cavity or bursa. $\times 13$.

locally (Fig. 3). There was no line of demarcation between the more or less normal appearing corium peripherally and the centrally located loose textured lesion. No large central cyst was seen, but there were several small cavities scattered through the areas of mucoid degeneration.

CASE 2. C. S. was a 54 year old man who complained of a cystic swelling on the right third toe of 1 month's duration. Examination showed a non-tender translucent raised and rounded swelling on the lateral aspect of the toe over the distal interphalangeal joint. This was incised and a clear viscid material like vitreous of the eye was evacuated with resultant collapse of the cyst. Cultures showed no growth. The wound healed *per primam*, but in 4 weeks' time there was recurrence and a mass 7 to 8 millimeters in diameter had reformed. Under local anesthesia this was excised and the sac wall of the cyst was completely removed. No communication with the neighboring joint could be demonstrated. The wound healed well. One month later there was evidence of a small fluctuant swelling beneath the old scar. This was punctured and a colorless viscid material was aspirated. Cultures of this showed no growth. Following the last aspiration the lesion quickly recurred and then gradually grew to attain a diameter of 8 millimeters during the course of the following 13 months. At this time local findings were those illustrated in Figure 1. The cyst was now somewhat translucent had a broad base and projected well above the surface of the surrounding skin. Amputation of the toe was decided upon and was performed.

Pathological examination of the first specimen showed a small elliptical piece of skin containing a centrally placed vesicle 7 to 8 millimeters in diameter which lay within the dermis and which was

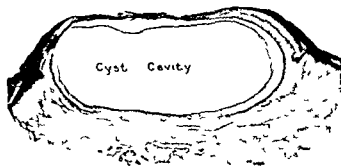


Fig 7 Photomicrograph of cross section of entire cystic lesion removed from a finger (Case 3). The smooth walled cavity lies wholly within the derma, for a narrow rim of this connective tissue can be traced over the entire dome of the cyst. There is no epithelial or endothelial lining of the cavity. There is no communication between the cyst and the deeper structures. The epidermis dips in deeply at either side of the cyst as though it is attempting to surround and extrude the lesion. For higher power detail see Figure 8. $\times 15$

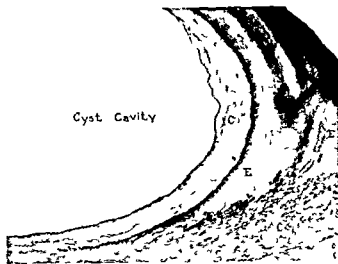


Fig 8 Photomicrograph showing detail from the right end of Figure 7. The connective tissue around the cyst cavity has a loose texture, which is seen best toward the right. There is no cyst lining. C, Corium, E, epidermis. $\times 50$

covered externally by a thin walled epidermal coat. This cyst had a faint bluish color, and incision of it produced a few drops of crystal clear viscid material resembling that of the vitreous humor of an eye. This was acid in reaction (to phenolphthalein indicator) and produced a white precipitate with acetic acid. Histologically there was a cyst lying wholly within the derma. While connective tissue entirely surrounded the cyst there was only a very thin (0.5 millimeter) layer of it superiorly separating the cyst cavity from the overlying epidermis. The cyst did not have any epithelial or endothelial lining, its walls being composed only of connective tissue of varying density. Around most of the cyst wall this tissue was somewhat dense and possessed a dense collagenous intercellular substance, but elsewhere it had a loose textured edematous or myxomatous appearance and collagen was quite scanty in amount. In the wall of the cyst, blood vessels were possibly somewhat more numerous than in normal corium, but this appearance may have been due to loss of local supporting substance and apposition of previously existing vessels. A few scattered lymphocytes represented the only leucocytic infiltration.

Pathological examination of the second surgical specimen (amputated toe) showed the cyst over the lateral aspect of the terminal interphalangeal joint as described in the clinical notes here given. The specimen was hardened in 10 per cent formalin (causing the cyst to shrink greatly) and was then decalcified in order that celloidin sections might be cut through the entire toe. Careful microscopic study was done and 28 sections were cut at various levels through the lesion for the purpose of ascertaining whether or not there was a connection with the synovial membrane of the adjacent joint. Nowhere did the lesion communicate with the joint nor was there any connection with the nail bed. The whole process was confined to the corium of the skin and

showed only a localized myxomatous tissue without sharp boundaries (Figs 4, 5, and 6). In the central portion of the lesion, the connective tissue had widely separated, delicate fibrils. The type of cell and cell processes resembled in general those found in embryonic connective tissue and that seen in myxomatous tumors (Fig 6). There was no leucocytic infiltration of importance. No abnormal vascularity appeared in the surrounding tissues and no thrombus was found in any vessel. There was no evidence of neoplasm. The process was regarded as a peculiar myxomatous degeneration of the corium.

CASE 3. F. C. was a 60 year old woman who originally noticed some abnormality over the dorsal aspect of the terminal interphalangeal joint of the right middle finger 2½ months prior to the time she sought medical attention. During the early part of this interval there was a mild pain and tenderness in the described region, but this disappeared and was followed by the production of a small swelling which was not particularly sensitive, but which was likely to be bruised and thereby made intermittently painful. Local examination showed evidence of slight hypertrophic arthritis of the fingers. Situated dorsally over the last interphalangeal joint of the fingers, and somewhat toward the ulnar side, there was a slightly raised swelling about 4 millimeters in diameter, such as is pictured in Figure 1. The covering of this was quite thin and the vesicle seemed to contain a clear fluid, though it was under great tension and was non compressible. Its base faded away into the normal surrounding skin without an areola of any sort. As a whole it was slightly movable over the underlying tissues. The fact that its fluid could not be pressed out made it certain that it did not communicate with a joint, bursa or tendon sheath. Under local anesthesia the entire lesion was cleanly and completely excised, without rupturing it. The

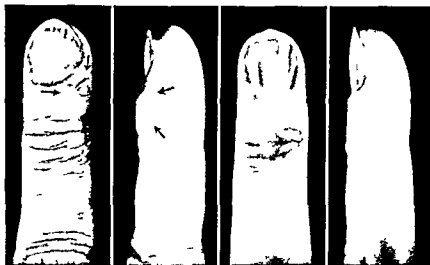


Fig 9 Myxomatous cyst of left middle finger (Case 4)

Fig 10 Same as Figure nine—4 months after x ray treatments

wound healed well but 2 months later a reddening developed in the scar and a slight elevation was evident which strongly suggested beginning recurrence. When seen again 6 months after the operation there was a slight elevation at the operative site without a definite vesicular appearance. Accordingly x ray irradiation was instituted (unfiltered rays—600 r—divided into 2 doses 2 days apart). Following this the mass disappeared and there is no further evidence of recurrence 1 year after x ray therapy.

Pathological examination showed an elliptical piece of skin in the central part of which was a rounded raised mass about 5 millimeters in diameter which produced a dome like swelling on the skin surface. The external surface of this rounded structure was smooth and did not have any fissures or hairs. The general character of the lesion was one of an unusual type of dermal cyst covered by a thin translucent membrane beneath which could be seen a droplet of clear fluid. In order to preserve the structure and the histological relationships of the mass it was first fixed in 10 per cent formalin and then a single section was made across it. When this cut was made a small well defined cavity was found which was filled with a pale slightly cloudy mucinous fluid (Fig 1). The corium of the adjacent skin extended down under the cyst and also a very thin layer traversed its roof (interposed between the cyst proper and the overlying epidermis). Histologically there was a clearly defined cyst situated wholly within the derma (Fig 7). Only a very thin layer of corium was seen between the cyst and the distended overlying epidermis but this finding characterized the lesion as being of dermal and not epidermal origin. Epidermal processes extended downward and inward at either side of the cyst (Fig 8), this arrangement taking place in such a way as to suggest that this might be an attempt on the part of the

epidermis to surround the cyst and possibly to extrude it. The inner lining of the cyst was smooth and consisted only of connective tissue of the corium, there being no epithelial lining. Immediately surrounding the cyst cavity the connective tissue of the walls had a loose texture which is seen best at either end of the cyst (Figs 7 and 8). Weigert stains for elastic tissue showed a definite decrease in the number and size of the elastic fibers in the loose textured areas immediately adjacent to the cyst cavity. The lesion appeared to be completely excised (yet there was recurrence as noted above).

CASE 4. J. B. was a 50 year old white woman who complained of a gradually enlarging cystic mass on the left middle finger. This lesion, which had been present for 5 months, was the seat of moderate discomfort when it struck against various objects. Examination showed a fluctuant cystic non tender swelling 11 millimeters long, 9 millimeters wide, and 6 millimeters thick over the dorsomedial aspect of the terminal phalanx which would transmit light. The nail, when viewed from the end of the finger, was flattened and depressed on its medial third. Not recognizing the character of this lesion we incised it and a clear myxomatous colorless substance was evacuated. By expressing the contents of the cyst a normal configuration of the finger was regained. Within 2 weeks time the cyst began to reaccumulate fluid and at that time the photograph of Figure 9 was taken. This illustration, therefore does not indicate the full size of the cyst before the original incision had been performed. Further treatment was instituted by a second incision and drainage 2 weeks later followed immediately by 2 x ray irradiations (2 days apart) employing unfiltered rays at 140 kilovolts with a total dose of 600 r. With this therapy the lesion had remained cured when seen 4 months later (Fig 10).

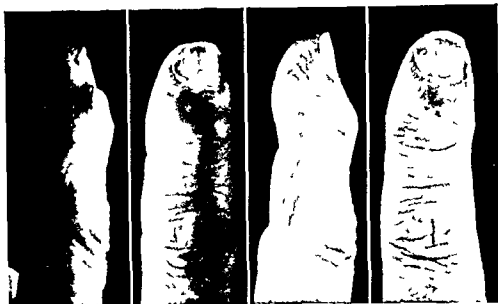


Fig 11 Left, Myxomatous cyst of corium on right index finger of 1 year's duration (Case 5). In the photograph on the right, notice the depression of the nail which is apparently caused by pressure on the nail bed by the adjacent myxomatous cyst.

Fig 12 Same as Figure 11—4 months after incision and drainage combined with x ray irradiation. The distal one half of the nail is still grooved, but the regenerated proximal half has a normal contour.

CASE 5 E. B. was a 65 year old white woman who complained of a small, hemispherical mass on the right index finger, which had been gradually progressing in size for 1 year and had interfered with her activities as a seamstress. On some occasions there was a local tenderness and pain, but these complaints were less annoying than the inconvenience caused by the swelling. Examination showed evidence of a moderate degree of hypertrophic arthritis of the terminal interphalangeal joint and also the lesion as seen in Figure 11. This mass, located on the dorsomedial aspect of the finger and situated just distal to the articulation, was definitely cystic, transmitted light, and was non tender. It was slightly fluctuant, smoothly rounded, and had a pinkish tinge. There was a slight grooving of the finger nail on this side, this change being apparently due to local pressure on the nail bed by the overlying cyst. Without performing a biopsy, 2 x ray treatments were given on 2 subsequent days, unfiltered rays and a total dose of 600 r being used at 140 kilovolts. Since there was no appreciable decrease in the size of the cyst during the next 6 weeks it was concluded that regardless of what change the x ray treatment had effected in the cyst wall the local swelling would persist until the contents of the cyst was evacuated. Therefore, incision was made into the cyst, the contents expressed, and a normal contour of the finger was obtained. The evacuated material was translucent, clear, glairy, and mucoid. The smooth internal surface of the cyst had a light gray color. A portion of the roof of the cyst was removed for biopsy. Wound healed promptly with no return of the cyst in subsequent 4 months (Fig 12). The regenerated finger nail developed a normal contour.

Pathological examination of the specimen showed the cyst wall to consist only of connective tissue of the corium (Fig 13). The corium, between the cyst cavity and the overlying epidermis, was essentially normal in appearance. Its collagenous tissue was fairly dense, this change being probably due to x-ray irradiation. The vascularity of the derma was slightly increased, and a few lymphoid cells surrounded the capillary vessels. These two features may also have been due to irradiation. The cyst cavity had no epithelial or endothelial lining. Some of the mucoid material removed from the cyst at operation, which had been fixed in Zenker's fluid, and

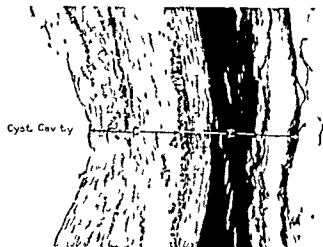


Fig 13 Photomicrograph of roof of cyst from Case 5 (Fig 11). The epidermis, E, and the corium, C, are essentially normal. The cyst cavity, which was filled with mucoid material, does not have any epithelial lining. $\times 125$.

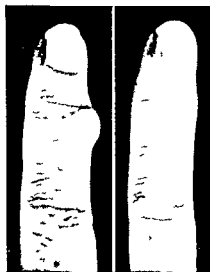


FIG 14. Left: Myxomatous cyst of right middle finger of 1 year's duration (Case 6). This lesion had been excised on two previous occasions. Right: Same finger 6 months later following two series of x ray treatments and subsequent excision and skin grafting. (The grafted area is slightly hyperemic and appears darker in the photograph than does the surrounding skin.)

sectioned showed an acellular and structureless mucous substance staining blue in the eosin methyl ene blue sections and a light brown in the phosphotungstic acid hematoxylin stains.

CASE 6. C. K. was a 46 year old librarian who complained of a swelling on the right middle finger of 1 year's duration. Three months after the appearance of this lesion it had been excised by her local physician and the cyst had recurred in 2 months. Three months after the first operation the lesion had been again excised but this was also followed by recurrence. Examination disclosed a thin walled fluctuant sac with a yellowish pink color over the dorso-lateral surface of the right middle finger lying just proximal to the distal interphalangeal joint which was 12 millimeters long 8 millimeters wide and 5 millimeter high (Fig 14 left). This



FIG 15. Photograph of gross specimen in cross section from Case 6. The cyst cavity (which was 4 millimeters in diameter) lay entirely within the corium. A thin layer of the corium can be seen extending over the roof of the cyst, separating it from the overlying epidermis. $\times 7$

cyst readily transmitted light. Under local anesthesia an incision with drainage was performed and a small piece of tissue at one edge was removed for biopsy. Two weeks later x ray therapy was instituted, giving 2 exposures—2 days apart—at 140 kilovolts unfiltered rays using a total dosage of 600 r. In spite of this treatment however there was recurrence of the cyst which nearly reached its former proportions in 8 weeks. At the end of the 8 week period the cyst was aspirated and about 1 cubic centimeter of colorless clear mucoid fluid was removed allowing the cyst to collapse. Further x ray treatment was immediately given (total dose of 960 r in 2 treatments 2 days apart unfiltered rays at 140 kilovolts). With this therapy the mass gradually reappeared during the next 4 weeks but reached a size only about one third that of its former volume. The skin surrounding its base was now quite firm and slightly thickened. The entire lesion was then completely excised and the area was covered with a Thiersch graft. There was no further recurrence (Fig 14 right).

Pathological examination of the first specimen showed unfortunately, that it had been cut from the cyst wall at a slant so that the inner surface of the cyst was not included in the block. The specimen did contain one thing of interest however for in the corium which must have been quite close to the cyst wall there was a large thin walled blood vessel containing an old fibrous but non vascularized thrombus. It was impossible to determine whether this thrombus was in some way related to the formation of the cyst (by altering local blood supply) or whether it had formed following the previous operative procedures.

Pathological examination of the second specimen showed an elliptical piece of skin 1 centimeter long 5 millimeters wide and 5 millimeters in maximum thickness. In the central portion of it there was a small vesicular swelling which bulged up on the



FIG 16. Photomicrograph of specimen which was removed from Case 6. The cyst has no epithelial lining. The cavity is intradermal in position. In the surrounding derma there was found no evidence of leucocytic reaction. $\times 15$

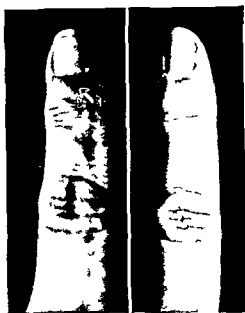


Fig 17 Left Small myxomatous cysts of corium on left index finger of 9 months' duration (Case 7) Right, Same, 4 months after incision and x ray treatment

skin surface and which apparently extended down into the derma. The external surface of this cyst was thin walled. There was some slight thickening of the skin around the base of the cyst. Examination of the under surface of the specimen showed no sinus or lumen of the cyst, this latter structure was, therefore, believed to have been completely excised and was devoid of communications with other cavities of the finger (such as tendon sheath or joint). Transection of the specimen disclosed a well defined cavity 4 millimeters in diameter in the center of the tissue, which cyst lay within the corium (Fig 15). Exuding from this cyst were a few drop lets of clear, colorless, sticky, glairy, gelatinous fluid. Microscopic examination (Fig 16) disclosed a cavity without endothelial or epithelial lining, the walls of which were formed by a corium of increased density. The surrounding derma had an increased cellularity, a dense collagenous structure, and only rare infiltrating leucocytes. In the zones 1 to 2 millimeters away from the cyst there were an increased number of dermal blood vessels of capillary size. The density of the corium and the increased vascularity were attributed to previous operative procedures and to x ray therapy. No communication could be demonstrated from the cyst to underlying structures.

CASE 7 (Same patient as Case 6) For a period of 9 months the patient had noticed a small cyst appearing over the terminal phalanx of the left index finger, for which no treatment had been instituted. Examination showed a small cystic swelling in the midline on the dorsal aspect of the terminal phalanx of the left index finger, lying just at the base of the nail (Fig 17, left). This cyst measured 5 millimeters in diameter and was raised 3 millimeters above the level of the surrounding skin. It readily

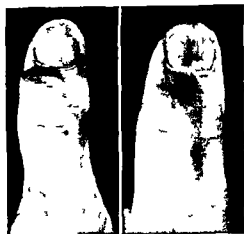


Fig 18 Left Thin walled, translucent myxomatous cyst of left thumb of 3 months' duration (Case 8) Right, Same, 4 months after incision and x ray treatment

transmitted light. The cyst was incised and a small bit of tissue was removed from its wall for biopsy. When the wound had healed, x ray irradiation was instituted—2 exposures, 2 days apart, 140 kilovolts and unfiltered rays being used, a total dose of 600 r. There was no evidence of recurrence of the cyst in the ensuing 4 months (Fig 17, right).

Pathological examination of the biopsy specimen showed a dense corium of increased cellularity with an abundant amount of collagen. The vascularity and the cutaneous appendages were normal. A few scattered lymphoid cells appeared around one of the smaller vessels. The portion of the cyst wall which was examined did not show a smoothly rounded cavity, but possessed very irregular side arms and outpocketings. The wall of the cavity showed only a connective tissue of the surrounding derma, there being no cyst lining.

CASE 8 M. K. was a 49 year old waitress who complained of a swelling on the left thumb of 3 months' duration. During this interval the local mass had gradually increased in size, and while there was no associated pain, the lesion produced some local discomfort when it was bumped against various objects. There had been no known trauma of importance. Examination showed a raised, ovoid cyst over the dorsal medial aspect of the terminal phalanx, quite unrelated to the interphalangeal joint, but lying rather close to the base of the nail (Fig 18, left). This thin walled cyst had a pinkish yellow tinge and readily transmitted light. It was 7 millimeters long, 12 millimeters wide, and 5 millimeters high. Under local anesthesia, a small transverse slit was made in the dome of the cyst and about 1 cubic centimeter of thick, clear, colorless and gelatinous material was expressed. This operation produced a normal contour to the finger. The interior of the cyst was unilocular, light gray, smooth, and had no outlet to the joint or other structure. The wound healed readily and after 1 week, x ray treatments were given to prevent recurrence. A total of 600 r was given, dividing this into

2 dose, 2 days apart at 140 kilovolts and employing unfiltered rays. Four months later there was no evidence of recurrence (Fig 18 right).

Pathological examination of the roof of the cyst and the overlying skin showed findings similar to those seen in the previous cases, namely a cyst wall unlined by epithelial or endothelial layer but surrounded only by connective tissue of the adjacent corium. The derma both adjacent to the cyst wall and elsewhere was essentially normal in appearance, had an abundant amount of intercellular collagen and lacked any inflammatory reaction. There was no abnormal vascularity of the corium. The cyst then, was an unlined structure lying within the corium and because of the absence of mucoid degeneration of its wall appeared to have been of considerable standing.

SUMMARY

Clinical and pathological descriptions are made of an uncommon cutaneous condition which is characterized by the formation of a small, recurring, myxomatous cyst of the skin on a finger or toe. The cyst is not lined by a secretory epithelial membrane nor does it take origin from an adjacent joint cavity, bursa, or tendon sheath. The lesion is a degenerative one and is produced by a peculiar mucoid change in the connective tissue of the corium, this process leading to liquefaction and cyst formation. The cause for this focal degeneration is unknown but may have some relationship to local trauma.

Fourteen cases are gathered from the literature for study and 8 additional examples are presented. Twenty-one of the lesions occurred on the fingers and 1 was observed on a toe. The cysts vary from a few millimeters in diameter to slightly more than a centimeter in greatest dimension. They are commonly located over the dorsal aspect of a distal interphalangeal joint and are usually situated a little to one side of the midline. The cysts

are thin walled and contain a colorless, glairy, mucoid, or gelatinous fluid. Three fourths of the patients were women. The youngest age at which the lesion has been described was 26 years, the oldest 66 years, with an average at 48 years.

These myxomatous cysts of the corium are very resistant to surgical forms of therapy and recur again and again after incision and drainage, curettage, cauterization, or even after local extirpation. Radium or x ray irradiation affords the best method of treatment and has been found useful in preventing a recurrence.

BIBLIOGRAPHY

1. BÉRARD and GUILLEMINET. Du traitement des kystes synoviaux par l'injection de teinture d'iode. *Lyon méd.* 1927 139 75.
2. CARP L. and STOUT A. P. A study of ganglion. *Surg. Gynec. & Obst.* 1928 4, 460.
3. CLARKE W. C. The pathogenesis of ganglia. *Surg. Gynec. & Obst.* 1908 7 56.
4. HYDE J. N. and MONTGOMERY F. H. Diseases of the Skin. 1st ed. p. 444. Philadelphia and New York: Lea Brothers & Co. 1897.
5. LETICIE, M. and BAZY L. Les Kystes dits Synoviaux du Poignet. *Ann. d'anat. path.* 1928 5 937.
6. LINGENFELTER G. P. A case for diagnosis. *J. Cutan. Dis.* 1913 31 647.
7. MACKEE, C. M. and ANDREWS, G. C. Synovial lesion of the kin. *Arch. Dermat. & Syph.* 1921 4 162.
8. Idem. The pathologic histology of synovial lesions of the skin. *Arch. Dermat. & Syph.* 1922 5 561.
9. MONTGOMERY D. W. and CLIVER, G. D. The pathologic anatomy of synovial lesions of the skin. *Arch. Dermat. & Syph.* 1932 5 329.
10. NACHLAS I. W. Cystic nodules of the terminal finger joints. *Arch. Surg.* 1932 25 1067.
11. ORMSBY O. S. Synovial lesions of the skin. *J. Cutan. Dis.* 1913 31 943.
12. SAVATARD L. Peri articular fibroma of the skin (synovial lesion of the skin). *Arch. Dermat. & Syph.* 1924 9 441.
13. SUTTON R. L. Radium in the treatment of synovial lesions of the kin. *J. Am. M. Ass.* 1916 66 565.
14. Idem. Diseases of the Skin. 6th ed. p. 517. St. Louis: C. V. Mosby Co. 1926.

CARCINOMA OF THE JEJUNUM

CHARLES W. MAYO, M.D., F.A.C.S., and WALTER SCOTT NETTROUT, M.D.,
Rochester, Minnesota

ALTHOUGH carcinoma of the jejunum occurs relatively infrequently, it does merit careful consideration. The problem concerns not only a serious lesion but also the accompanying depletion of physical reserve which increases the risk of treatment. For this reason it seems advisable to record our observations in the hope that they may aid in establishing certain criteria for an early diagnosis so that more satisfactory results may be obtained in a larger number of cases.

Of the malignant tumors of the small intestine, sarcomas occur more frequently than do carcinomas. In 1904, Nothnagel reported 243 instances of intestinal sarcoma in 24,358 necropsies, in 6 of the cases the growths were in the ileum and in none of the cases was the growth in the jejunum. On the other hand, Corner and Fairbank, in 1905, reviewed 103 cases of sarcoma of the intestine, in 63 per cent of these cases the growths were in the small intestine and in the majority of the latter cases the growths were in the ileum. The age incidence of intestinal sarcoma is between 30 and 40 years.

Carcinoma has been said to be relatively rare in the portion of the intestine between the pylorus and the ileocecal junction. Hinz, in a study of 584 cases of carcinoma of the intestinal tract, found that the growth was in the small intestine in 18 cases. Bunting reported one instance of carcinoma of the small intestine in 2200 necropsies. Ewing found that 3 per cent of all intestinal carcinomas occurred in the jejunum or ileum. From these reports, it is easy to see that there is a wide variation in the frequency with which carcinoma of the small intestine is found.

D'Allaines, in 1929, collected and reviewed 114 cases of primary carcinoma of the small intestine. Twenty-six of these cases were

From the Section on Surgery, The Mayo Clinic and The Department of Surgery, The Mayo Foundation.
Dr. Nettrott now resides in Austin, Minnesota.

observed at The Mayo Clinic and were reported from a pathological standpoint by Craig Rankin and Mayo, in 1929, collected and reviewed 55 cases of verified primary carcinoma of the small intestine, including 24 cases which had been reported by Judd in 1919. In 1935, Plunkett, Foley, and Snell reported 14 additional cases. To these, we wish to add 7 cases in which the diagnosis of carcinoma also was confirmed pathologically at operation or at necropsy. This brings the number of cases of carcinoma of the small intestine, seen at the clinic prior to February 1, 1936, up to 76. We have found 60 other reported cases which bring the total cases in the literature to considerably more than 200. There is no obvious reason why carcinoma should be relatively rare in the small intestine.



Fig. 1. Obstruction in the jejunum which was interpreted as carcinoma (Case 29).



Fig 2 Carcinoma of jejunum (Case 20)

The numerous theories are interesting but far from conclusive. Ewing reported that 8.56 per cent of all intestinal carcinomas originated in the small intestine and that slightly more than half of these originated in the duodenum. In the cases of carcinoma of the small intestine which have been observed at the clinic the distribution is somewhat different.

In 31 cases the growth was situated in the jejunum; in 21 cases it was in the duodenum and in 18 cases it was in the ileum. In 4 cases carcinoma was present in more than one portion of the small bowel and in 2 cases the site of the growth was indeterminate. We have reviewed the entire series of cases observed at the clinic and are reporting the findings in the 31 cases of primary carcinoma of the jejunum. We have purposely omitted the cases in which carcinoma of the jejunum



Fig 3 Resected portion of jejunum in Case 30

was associated with carcinoma of the stomach, colon and genital tract and those cases in which carcinoma involved more than one portion of the small intestine. Those cases in which microscopic examination revealed the presence of argentaffin tumors (carcinoids) also have been omitted. We believe that it is only in this fashion that the true clinical picture of carcinoma of the jejunum can be evaluated.

INCIDENCE ACCORDING TO AGE AND SEX

In this series of cases of carcinoma of the jejunum, 20 of the patients were men and 11 were women. The ages of the patients varied from 34 to 67 years. The average age of the men was 50.25 years and that of the women was 52.5 years. The average age of the entire group was 51 years. In approximately a third of the cases there was a history of carcinoma among some of the blood relatives of the present or preceding generation.

At the clinic, 2513 cases of carcinoma of the stomach, 2767 cases of carcinoma of the colon, including the rectum, and 25 cases of carcinoma of the small intestine were observed from 1921 to 1930, inclusive. In this same period in 8 of the cases of carcinoma of the small intestine the growths were situated in the jejunum. In this 10 year period 0.47 per cent of all gastro intestinal carcinomas involved the small intestine. This compares favorably with the incidence of 0.62 per cent reported by Rankin and Mayo in a similar series of cases. In the 10 year period carcinoma of the jejunum comprised 0.15 per cent of the total number of carcinomas of the gastro intestinal tract. Seventy-six carcinomas of the small intestine have been observed at the clinic, these comprise 0.62 per cent of all carcinomas from the cardiac end of the stomach down to and including the rectum.

Symptoms

In Table I it may be seen that in about 80 per cent of the cases there was a rather typical clinical history of a lesion of the small intestine. This percentage undoubtedly was increased by carefully questioning the patient after the lesion had been discovered at the time of operation. Such questioning often elicited a typical history. Cramps and epigastric discomfort are most commonly the chief symptoms. Usually, there is a history of recurrent short episodes of intestinal obstruction, associated with cramps, nausea and vomiting. These symptoms occur for 3 to 4 months and tend to become more frequent and more severe. Although there is not always a relationship between the symptoms and meals, the cramps, when present, occur about 3 to 4 hours after eating "Gas," "rumbling," and "bloating" are common symptoms.

Weakness and easy fatigability are prominent symptoms and a careful history often reveals that these and anemia antedate the gastro-intestinal symptoms. Loss of weight is a prominent symptom and may cause the patient to seek medical advice. There is more constipation than usual and melena and hematemesis occur occasionally. The most important symptoms will be considered individually.

Colic Abdominal pain was an outstanding symptom in 26 cases. It is difficult to evaluate the short cramping type of pain and the more or less constant stationary type of pain, the cause of the gradations present in both. Localized pain, which varied from dull to moderately severe, was present in 6 cases, while patients complained only of abdominal distress or discomfort. Abdominal cramps were the chief symptoms in 17 cases. The site of the pain was usually in the epigastrium below the umbilicus, which according to Rivett corresponds to the site of referred pain caused by lesions in the jejunum. Cramps, when present, were prominent in this region, as well as across both lower quadrants of the abdomen. There was extreme variation in the duration of colic, which lasted from several seconds to 3 or 4 hours.

Anemia Fatigue, weakness, and general malaise were constant but were frequently secondary to the gastro-intestinal symptoms. Frequently, there was a history of progressive anemia which had not responded to treatment. Laboratory tests showed the anemia to be of the microcytic, hypochromic type. The average number of erythrocytes was 3,730,000 per cubic millimeter of blood. The mean value for the hemoglobin was 59 per cent. Necropsy demonstrated that hemorrhage was the cause of death in Case 12, which was the only case in which operation was not performed. Plunkett and his coworkers have pointed out that the anemia may result from both the occult bleeding and the interference of the absorptive function of the small intestine. In 1913 and 1921, W. J. Mayo called attention to the marked anemia associated with carcinoma of the proximal half of the colon. The marked anemia in these cases of carcinoma of the jejunum is comparable to the anemia associated with lesions of the proximal half of the colon and may be attributable to some change in intestinal absorption or to the absorption of the gastro intestinal hematemesis substance described by Castle and others.

Loss of weight Loss of weight occurred in all but 3 cases. In 2 of the cases there was a change in weight and in 1 there was a loss of 5 pounds (2.3 kilograms). The average weight was 25 pounds (11.3 kilograms).

Vomiting Vomiting was a variable symptom both in incidence and degree. Frequently, vomiting was self induced to obtain relief. While vomiting was more frequent when the upper portion of the jejunum was involved, this was not a constant finding since marked vomiting occurred in Case 23, in which the distal portion of the jejunum was involved, and there was an absence of vomiting in Case 11, in which there were several lesions in the proximal portion of the jejunum. The degree of intestinal obstruction appeared to be the main factor in the production of vomiting. There was no history of vomiting in 11 cases, the vomiting was slight or moderate in 9 cases, marked in 9 cases and extreme in only 2 cases. With few exceptions, it was intermittent and followed the other obstructive symptoms.

Constipation In several cases, constipation was one of the chief complaints but it was a minor symptom in many cases. Constipation was present in more than half of the cases (17) but it never was intractable. Moreover, 6 patients gave a definite history of diarrhea, most commonly a mild diarrhea which alternated with periods of constipation or normal bowel movements. Constipation, while a common symptom, is too variable to be of diagnostic value.

Melena While melena was not a frequent complaint, it occurred in 6 cases.

SPECIAL TESTS

Occult blood The presence of occult blood in the stool is a very valuable sign and the test should be used more frequently than it is. By this test the careful clinician often obtains the first clew as to the real nature of the patient's trouble. It is striking to note that strongly positive reactions were obtained in all cases in which the occult blood test was employed.

Gastric analysis Gastric analysis was made in 20 of these cases. In 6 there was gastric retention which varied from 370 to 1000 cubic centimeters. Hyperchlorhydria was present in only 1 case, in which the value for the total acid in the stomach was 70, according to the method of Toepfer. Achlorhydria was present in 12 cases.

ROENTGENOLOGICAL EXAMINATION

The decision as to whether roentgenological examination should be carried out must necessarily be based on the clinical findings. The symptoms of previous attacks are frequently so suggestive of intestinal obstruction that the use of barium (especially by mouth) is not only of little aid but may constitute a definite hazard. Roentgenological examination with a contrast medium has been very useful in demonstrating the absence of lesions of the stomach, small intestine, and colon in cases in which there are present vague, indefinite, gastro intestinal symptoms and in cases of unexplained anemia. A positive roentgenological diagnosis was made in 10 cases (Cases 6, 7, 14, 22, 23, 24, 27, 28, 29, and 31). Gabor and Hiller have pointed out that retention of barium in the small intestine for more than 8 hours should arouse suspicion.

The roentgenogram of carcinoma of the jejunum reveals a narrowing of the intestinal lumen at the site of the lesion and compensatory widening proximal to the obstruction. Coiling of the intestinal loops proximal to the lesion and distention are frequent findings.

The observation of barium in the small intestine is rather difficult, but the clinical history and the roentgen exclusion of the presence of a lesion in the stomach or colon frequently will furnish presumptive evidence of a lesion of the small intestine. In Cases 27 and 28, x ray examination of the colon revealed the presence of an extrinsic mass suggestive of a neoplasm of the small intestine.

Figure 1 shows a jejunal tumor which has produced partial obstruction of the intestine. The history in this case (Case 29) was rather indefinite, but the patient had had severe cramps and had noted distention and rumbling in the abdomen. The lesion which was found at operation is shown in Figure 2. The patient had undergone a cholecystectomy a short time before she came to the clinic. A previous roentgenological examination of the intestine, which had been made prior to her admission to the clinic, had not revealed any abnormality.

DIAGNOSIS

It is neither important nor possible clinically to differentiate carcinoma of the jejunum

TABLE I.—CLINICAL DATA IN 31 CASES OF CARCINOMA OF THE JEJUNUM

Case	Year observed	Age—years— and sex	Principal symptoms	Pounds lost	Duration of symptoms months	Blood			Gastric acidity*		Site of lesion	Operative and pathologic findings	Outcome
						Hemoglobin per cent	Erythrocytes thousand per cu mm	Leucocytes per cu mm	Total	Free			
1	1907	39 M	Gas rumbling cramps	50	3				25	0	Upper part of jejunum	Obstruction carcinoma	Died in 21 months
2	1909	40 M	Epigastric pain, vomiting	25	3	50	4.53	6 800			Upper part of jejunum	Obstruction, ascites metastasis	Unknown
3	1900	49 F	Cramps rumbling tenderness	12	2½	55					Upper part of jejunum	Obstruction, peritoneal nodules	Died in 4 months
4	1912	46 F	Cramps vomiting	20	36	39	3.34	5 900	4½	0	Upper part of jejunum	Large tumor metastasis	Died in 6 months
5	1913	41 M	Cramps vomiting weakness	54	10				50	40	Upper part of jejunum	Ring carcinoma metastasis	Died in 22 months
6	1913	57 M	Alternating constipation and diarrhea vomiting	23	9				4½	40	Upper part of jejunum	"Spool sized carcinoma	Died in 12 days
7	1915	51 M	Fullness distress vomiting	40	6	80	4.03	9 900	36	22	Upper part of jejunum	Obstruction no metastasis	Died in 91 months
8	1916	34 F	Epigastric mass rumbling pain	6	2						Upper part of jejunum	Obstruction metastasis	Died in 3 days
9	1916	45 M	Pain, vomiting melena	20	4			11 200			Middle of jejunum	Obstruction carcinoma grade 4	Died in 14 months
10	1917	65 M	Cramps gurgling	85	24	82		7 000			Middle of jejunum	Obstruction ascites metastasis	Died in 59 months
11	1918	47 M	Cramps loss of weight	20	2½	74			36	20	Upper part of jejunum	Obstruction three epitheliomas metastasis	Died in 4 months
12	1918	45 M	Cramps melena fever	10	2	25	2.06	27 000			Upper part of jejunum	No operation ulceration obstruction metastasis	Died 16 days after admission to clinic next day
13	1919	50 M	Pain vomiting	20	12	77		11 200	4½	28	Middle of jejunum	Obstruction metastasis	Died in 1 month
14	1927	61 M	Vomiting distress hematemesis	20	3	68	3.30	8 700			Upper part of jejunum	Obstruction metastasis adenocarcinoma	Died in 2 months
15	1927	67 M	Fatigue anemia melena	0	9	36	3.10	6 000	22	0	Distal part of jejunum	Obstruction annular adenocarcinoma	Died in 12 months
16	1927	43 M	Weakness vomit log	24	8	42	3.47	9 500	28	0	Upper part of jejunum	Slight obstruction metastasis	Died in 5 months
17	1928	67 F	Vomiting pain rumbling jaundice	40	4	45	3.85	4 650	12	0	Mid jejunum	Obstruction annular adenocarcinoma	Died in 8 days
18	1928	46 F	Cramps vomiting	12	12	75	4.54	9 300			Upper part of jejunum	Obstruction colloid carcinoma metastasis	Died in 21 months
19	1929	43 M	Anemia, cramps vomiting	0	24	28	3.17	6 400	94	70	Upper part of jejunum	Obstruction adenocarcinoma grade 2	Alive
20	1929	57 M	Distress cramps melena	11	6	34	3.18	10 600	10	0	Upper part of jejunum	Obstruction carcinoma grade 4 metastasis	Alive
21	1929	60 F	Diarrhea cramps vomiting	24	2½	73	4.91		32	12	Upper part of jejunum	Obstruction adenocarcinoma grade 4 metastasis	Died in 13 months
22	1931	59 M	Backache discomfort weakness	36	5	71	4.32	9 800			Upper part of jejunum	Obstruction carcinoma grade 3 metastasis	Died in 25½ months
23	1931	49 F	Cramps rumbling vomiting	30	7	71	4.90	6 800	20	0	Lower part of jejunum	Obstruction annular adenocarcinoma grade 2	Died in 25 months
24	1932	40 F	Vomiting loss of weight	48	5	97	4.50	17 200	18	0	Upper part of jejunum	Obstruction ring adenocarcinoma grade 2	Died in 3 days
25	1932	45 M	Cramps mass vomiting	15	9	37	3.71	7 200			Jejunum	Perforation obstruction	Died in 12 months
26	1933	64 M	Constipation dull pain anemia	15	24	49	3.92	10 300	10	0	Lower part of jejunum	Obstruction perforation adenocarcinoma grade 4	Unknown
27	1934	43 M	Weakness loss of weight anemia	54	48	50	3.83	7 900	30	24	Jejunum	Obstruction metastasis adenocarcinoma grade 3	Died in 4 months
28	1934	50 M	Colic cramps anemia	0	7½	51	3.13	8 600	20	0	Upper part of jejunum	Obstruction metastasis	Died in 14 days
29	1935	61 F	Rumbling distention cramps	24	4	92		9 100			Upper part of jejunum	Fixed annular adenocarcinoma grade 2	Died in 9 days
30	1935	57 F	Cramps anemia melena	5	2	82	4.02	3 600	50	36	Upper part of jejunum	Annular ulcerating adenocarcinoma grade 3	Alive
31	1936	57 F	Cramps loss of weight melena	37	8	70	2.63	3 800	10	0	Upper part of jejunum	Metastasis adenocarcinoma grade 3	Alive

*According to method of Toepfer

and carcinoma of the lower portion of the duodenum or ileum. In a large percentage of cases, symptoms of intermittent intestinal obstruction, symptoms referable to anemia, and additional laboratory tests have been a great aid in the diagnosis of carcinoma of the small intestine in recent years. A positive test for occult blood is a very important finding.

At the age at which cancer occurs, other diseases are often present, which may not only confuse and distort the clinical picture but also may mislead the surgeon unless a careful exploration is performed. In 5 of the cases in this series (Cases 17, 21, 23, 26, and 29) there had been typical attacks of cholecystitis and gall stones were found to be present at operation. In Cases 2 and 30 (Fig. 3) the patients had duodenal ulcers, and in Case 16 a gastroenterostomy had been performed previously for a duodenal ulcer, and a rib had been resected because of pneumococcal empyema. A sixth of the patients had been treated previously for anemia, but improvement had not occurred. Diverticulitis, migraine, adenomatous goiter and tuberculous scoliosis also were found in some of the other cases of carcinoma of the jejunum included in this report.

SURGICAL TREATMENT

These cases represent the experiences of 16 surgeons. Resection and entero anastomosis were the procedures of choice and could be performed in 15 (48 per cent) of the cases. Of the palliative surgical procedures, entero anastomosis was performed in 11 (35 per cent) of the cases, while gastroenterostomy was performed in only 2 cases. In 2 cases the abdomen was closed after an exploratory laparotomy, and in 1 case no surgical treatment was given. A detailed description of the surgical technique has been reported previously by one of us (Mayo).

PATHOLOGICAL CHANGES

The typical tumor is an annular, obstructing adenocarcinoma similar to that found so commonly in the distal portion of the colon. Polyps, which were undergoing malignant degeneration, occasionally were found. A detailed description of the pathological changes in these

cases will be reported at a later date. The lesion was situated in the upper part of the jejunum in 22 of the cases and in a surprisingly large number of cases it was situated at or within a short distance of the ligament of Treitz. In 4 cases the lesions were situated in the middle portion of the jejunum and in 3 cases they were in the distal portion of the jejunum. In 2 cases the situation of the lesion in the jejunum was not described.

Metastasis. Metastasis is a common accompaniment of malignancy in the small intestine. Metastatic invasion first occurs in the mesenteric lymph nodes and peritoneum, then in the liver, lungs, long bones, and dura mater of the spinal cord, in the order named. Metastasis takes place probably at an early stage and obviously influences seriously the undesirable outlook of lesions in this situation. In a study of 12 cases of jejunal carcinoma Craig found metastasis in all but 1 case. In more than half of the 31 cases which form the basis of this report, demonstrable metastasis was reported by the surgeon or the pathologist.

PROGNOSIS

The prognosis of carcinoma of the jejunum, like the prognosis of carcinoma in other parts of the small intestine, is unsatisfactory, regardless of whether or not the growth can be removed. To get a general picture of the prognosis the patients have been divided into two groups. The first group, which includes those patients who are living at the present time, consists of only 4 patients. However, 2 of these have lived more than 7 years from the time of operation. In considering the small number of patients who are alive, it should be remembered that the cases have been observed in the course of a great many years. In the second group, in which the prognosis is less favorable, only 2 patients lived more than 3 years since the operation. One of these patients (the patient in Case 7) lived for more than 7 years after the operation and the other patient (the patient in Case 10), who was subjected to a palliative jejunojejunostomy, lived in comfort for almost 6 years since the operation. The average length of life for the second group of patients was 17.6 months. Although the patients lived

only a short time, the relief of obstruction and the comfort of the patients seemed to justify the surgical procedures. Perhaps the digestive activity of the jejunum, the abundant supply of lymph, and the high grade of malignancy are important factors in the gravity of the prognosis.

CONCLUSIONS

1 Carcinoma of the small intestine is infrequent and comprises 0.47 per cent of carcinomas of the gastro-intestinal tract.

2 The jejunum is the most common site for carcinoma of the small intestine, and carcinoma of this region represents 0.15 per cent of all gastro-intestinal carcinomas.

3 Intermittent attacks of intestinal obstruction with progressive anemia, in the presence of normal roentgenograms of the stomach and colon, should suggest primary malignant disease of the small intestine.

4 The presence of occult blood in the stool appears to be a rather constant finding and the occult blood test should be performed in every case in which there is vague abdominal pain.

5 This condition must be kept in mind in any case of unexplained anemia.

6 The operative mortality of carcinoma of the jejunum is 20 per cent, while the average duration of life is 17.6 months following operation.

7 The comfort of the patient justifies the surgical relief of obstruction in the jejunum.

REFERENCES

- 1 BUNTING, C. H. Multiple primary carcinomata of the ileum. *Bull. Johns Hopkins Hosp.*, 1904, 15: 349-394.
- 2 CASTLE, W. B., TOWNSEND, W. C., and HIRSH, C. W. Observations on the etiologic relationship of achylia gastrica and pernicious anemia. *Am. J. M. Sc.* 1930, 180: 305-333.
- 3 CORPSE, J. M., and LUKBANK, H. A. I. Symptomatology of the alimentary canal, with report of a case. *Br. Path. Soc. London*, 1905, 56: 20-42.
- 4 CRAIG, W. MCK. Lymph glands in carcinoma of the small intestines: a review of the condition of the glands in carcinoma of the gastro-intestinal tract. *Surg., Gynec. & Obst.*, 1924, 38: 479-485.
- 5 DALLAVALLE, I. Sur l'epithelioma primitif du jejunum. *J. de chir.*, 1909, 33: 449-472.
- 6 LEWIS, JAMES. *Neoplastic Diseases*, 2d ed., p. 661. Philadelphia: W. B. Saunders Co., 1922.
- 7 GIBSON, M. I., and HILLER, R. I. Primary carcinoma of the jejunum. *Am. J. Surg.*, 1935, 27: 121-125.
- 8 HIRZ, RICHARD. Ueber den primären Duodenalkrebs. *Arch. f. klin. Chir.*, 1912, 99: 305-162.
- 9 JUDIN, L. S. Carcinoma of the small intestine. *Journal Lancet*, 1910, 39: 159-169.
- 10 MAYO, W. J. Some of the disputed problems associated with surgery of the large intestine. *Am. J. M. Sc.* 1913, 145: 157-161.
- 11 Idem. Pernicious anemia with special reference to the spleen and the large intestine. *Ann. Surg.*, 1921, 74: 355-359.
- 12 NOTHHAU, H. *Spezielle Pathologie und Therapie*, 1904, 17: 308.
- 13 PLUNKETT, J. F., FOLEY, M. P., and SWILL, A. M. Primary carcinoma of the jejunum. *Canadian Med. Ass. J.*, 1936, 34: 289-293.
- 14 RANKIN, F. W., and MAYO, C. W. Carcinoma of the small bowel. *Surg., Gynec. & Obst.*, 1930, 50: 939.
- 15 RIVERS, A. B. Pain in benign ulcers of the esophagus, stomach and small intestine. *J. Am. M. Ass.*, 1935, 104: 169-174.

THE EFFECT OF THROMBOPHLEBITIS ON THE VENOUS VALVE

EDWARD A. EDWARDS, M.D., and JESSE E. EDWARDS, M.D., Boston, Massachusetts

BOTH the pathology and the clinical course of phlebitis might lead one to expect that this disease process should involve the venous valve. It seemed to the authors that the organization of a thrombus must effect some changes in the thin valve flap that lies buried within it. Clinically, we sought in such valve damage the answer to the permanent disability of the post phlebitic limb (phlebitis of the deep veins). Such disability, manifested by cyanosis, edema, and easy fatigue, may indeed occur and persist even after an adequate lumen is established by recanalization, and even after accompanying varicosities (if they exist) have been cured by ligation and injection. This suspicion of valve damage was strengthened by our observation that varices of the leg may increase in severity if a previously well valved saphenous vein were sclerosed by injection. After such treatment either recanalization of the saphenous or dilatation of collaterals may occur (3), and one frequently finds a quickly developing reflux of blood in the veins. In other words one has brought about, or hastened the valvular incompetence of the trunk that feeds the varices. Still one more observation suggested the thesis of valve damage. Varicose ulcers occurring after phlebitis of the deep veins are especially stubborn and are usually accompanied by incompetence of the valves of the perforating veins. This situation was discerned by Homans, who in 1916 wrote "In this case the valves are suddenly and universally crippled possibly by the organization of the thrombus."

We have been able to find only one direct observation of the venous valve after phlebitis. Beneke (1890) in discussing organization

From the Surgical Research Laboratory, The Boston City Hospital, the Department of Surgery, Tufts College Medical School, and the Mallory Institute of Pathology, The Boston City Hospital. Aided by a grant from the Charlton Research Fund. Read before The New England Heart Society, Boston, Massachusetts, December 14, 1935.

of thrombi, stated that where a thrombus overlays a normal valve, no organization proceeds from the free part of the valve cusp. "But if the valve be fixed in any way, as by adhesion to a previously organized thrombus a true organization can proceed from the valve flap."

We have not been able to find descriptions of the actual events during the active phlebitis. It is interesting, however, to note the description of the destruction of an analogous structure, the lymphatic valve, by Benda (1911). In describing the course of tuberculosis of the thoracic duct, he writes "The ulceration frequently attacks the valves, and disrupts them into small fragments. The changes are so severe as to make most of the valve disappear." He published a drawing showing the microscopic appearance of the fragmented elastica of the valve lying within the fibrin and caseous tissue.

Because of the paucity of previous observations we thought it fitting to study the actual histology of the venous valve during the entire course of phlebitis. This paper is a report of this study. The material is partly from the human, and partly from dogs. In the latter a phlebitis was produced by chemical irritation of the femoral vein.

METHOD OF STUDY

Sixteen dogs were used for the study of the artificially induced phlebitis. Each femoral vein was operated on twice, the phlebitis was produced at the first operation, and the segment of vein containing the valve was excised for examination at the second. The interval between the production of the phlebitis and the excision of the vein varied with each dog, so that the process could be followed through its various stages.

To produce the phlebitis at a valve site, the femoral vein was isolated in the trigone. Here, just below the entrance of the deep femoral

vein, there is constantly a valve, and in some cases a second one a few millimeters lower. When the vein is stripped free of its sheath, the attachment of the two cusps (the valve is usually bicuspid) is seen as two crescentic, transverse, opaque white ridges, an appearance that we may call the valvular arcade. In order to be sure of including the valve in the future excision, this area containing the valve was demarcated at the very start, since the onset of the phlebitis rendered it impossible to see the arcade at any later time. Accordingly, sutures of heavy linen were placed in the muscle medial to the vein, one above the arcade and one below, demarcating a piece of vein about 1.5 centimeters long. The ends of the sutures were left long and were easily found at the second operation. One or two small tributaries which entered the vein were cut between double ties.

The segment of vein was isolated by gentle clamping above and below, and was injected with a few drops of sodium morrhuate.¹ The vein was flushed out with the sodium morrhuate, and then a little blood was allowed to enter it. We found that leaving in any more of the material diluted the blood to such an extent that the clot was too soft to remain after removal of the clamps. At the beginning of the study a 5 per cent solution was used, which produced only a partial thrombosis. We later changed to a 10 per cent solution, which gave a complete thrombosis. The clamps were left on for 40 to 90 minutes, in order to ensure a good clot, and then removed. The wound was closed by sutures.

At the second operation the demarcated segment of vein was laid bare. We wished all the microscopic sections to be cut uniformly in a longitudinal direction and perpendicular to the plane of the cusps, as in Figure 1. This was accomplished by heeding the orientation of the cusps to surface planes as established in a previous study (4). To ensure this proper orientation, the anterior surface of the vein was marked with ink as soon as the vein was exposed. The demarcated segment was then excised.

Only one human specimen was artificially produced (Figs 13, 15). In this instance, a

good valve was demonstrated in the saphenous in the leg and demarcated by a silver nitrate stain on the skin. The vein was then injected with sodium morrhuate, and this segment of the thrombosed vein was removed 10 weeks later. All the other human veins studied were from patients with spontaneous phlebitis. Some of the specimens were obtained at operation, the others at autopsy. These human specimens could not of course be placed in a chronological sequence as accurately as the dog veins.

While in the case of the veins of the dogs, the placing of the demarcation sutures left no doubt that the sectioned vein had previously contained a valve, yet the actual identification of the cusps was difficult within the mass of clot and organization. This was even more true in the human veins. The use of Verhoeff's elastic tissue stain finally proved that the given segment of vein contained, or had contained, a valve. The valve cusps contain a fine membrane of elastic tissue beneath their contact surfaces. This elastic tissue, when stained, shows up well within the organizing thrombus. Counterstaining with van Gieson's stain further allowed a differentiation of the old collagen of the valve from the new fibroblastic tissue.²

COMPLETE THROMBOSIS

For purposes of clarity we describe the changes under the following headings:

- 1 Mobilization of the organizing elements
- 2 Fibroblastic proliferation
- 3 Fragmentation of the valve cusps
- 4 Recanalization

1 Mobilization of the organizing elements

The most prominent changes, in this stage, occur at the junction of the cusp and the vein wall, a region which we may call the valve base. Here there is normally a capillary which is small and hardly discernible. With the advent of the irritant responsible for the phlebitis, as well as the irritation of the clot, there comes about a dilatation and branching of this capillary. The vessel becomes really sizable and its branches are traceable into the cusp proper (Figs 3, 11). In some instances

¹Supplied by Searle & Co.

²With the exception of Figure 12 in all the photomicrographs shown in this paper the specimens were thus stained.

the irritation caused a diapedesis of red cells or an actual rupture of the capillaries in the cusp, with hemorrhage. This was visible in the bland thromboses of the human and dog specimens, but was most marked in a case of infected phlebitis in a dog.

The passage of the dilated and new capillaries across the base deserves closer examination (Fig 10). The junction of the elastic lamina of cusp and vein wall is in the shape of a Y. As one follows the well formed sheet of elastic tissue of the cusp to its lateral extremity, it can be seen to course *distally* in a curve to run without interruption into the internal elastic lamina of the wall. *Proximally*, however, in the region of the angle the junction of the two elastic membranes has a different appearance. Here the elastica of the vein wall is more abruptly attached to the elastica of the cusp, this union not being effected by a single membrane but rather by a coarse network of elastic tissue.

The capillary of the valve is located closer to this proximal junction of the elastic tissue than to the distal more solid part. When the capillary proliferates the path of its branches lies directly across the network of elastic tissue. This tissue is thereby broken up further and thus allows the passage across it of the capillaries as well as of lymphocytes macrophages, and fibroblasts (Figs 3, 10, 11). The distal portion of the elastic junction seems to form a better barrier and is disrupted to a lesser degree.

2 Fibroblastic proliferation. At the same early stage to which the mobilization process pertains, fibroblastic proliferation and organization of the clot has already begun. The earliest appearance of the fibroblasts, and consequent deposit of collagen is seen in the angle of the valve sinus and this may well be due to the ease and rapidity with which the capillaries described above can reach it.¹ The organizing tissue fills the angle immediately binding the proximal part of the cusp to the vein wall. As the organization progresses, it soon fills the entire sinus, causing adhesion of the entire length of the cusp (Figs 3, 10, 11).

The fibroblasts are at first less plentiful

along the contact surface of the cusp, but nevertheless, do cover it. The cusp is thus very soon completely imbedded in the young, vascular connective tissue. During the clotting of the blood the valve may have become considerably linked and folded. The subsequent contraction of the fibroblasts increases this distortion and causes an adhesion of the folds to each other (Figs 5 and 12). The cusp is thus shortened (Fig 10). If the cusps happen to lie close to each other at the moment of clotting then the fibroblasts along their contact surfaces will cause them to adhere to each other.

The new connective tissue, originally made up of fibroblasts, becomes more persistent with the production finally, of collagen. This material is distinguishable in many of the older specimens, through the use of van Gieson's stain, and Mallory's connective tissue stain.

3 Fragmentation of the aortic cusps. All the changes incident to phlebitis focus on this one practical point, the destruction of the valve cusp. The valve collagen is least resistant to the lytic forces and disappears first but the elastic tissue is tough and can be followed, even though it be in fragments to the very end of the metamorphosis of the thrombus.

The quickest lysis is by ulceration, a process which is seen only in septic phlebitis (Fig 4). In ordinary bland phlebitis, the earliest disruption is that already described at the base. At this same time, the cusp may be torn by hemorrhage from its capillaries, as noted in the previous section.

As soon as fibroblasts and capillaries surround the valve, the cusp is progressively fragmented by these two elements. We do not know exactly how or when the endothelium of the cusp disappears, but the fibroblasts and capillaries are seen in contact with its bare connective tissue and penetrating into it (Fig 12). The collagen is seen as small masses of pale staining material but the elastic tissue can be followed as small sheets which later may also be broken up into small frayed bits.

At this stage the continued growth of the capillaries furnishes a continuing progressively stronger disrupting force which will be considered under the next heading.

¹Bencke used this localization of earliest organization to strengthen his argument that the fibroblasts develop earliest where there is most resistance to the pulling force exerted by a shrinking thrombus.

4 *Recanalization* The organization of any sizable thrombus is always associated with a vascularization of the organizing connective tissue. It is rare, indeed, not to find that many of the vessels have a connection beyond the ends of the thrombus, bridging across from one open part of the vein to the other. And, therefore, while clinically we may speak of the presence or absence of recanalization in a thrombosed vein, we really mean to distinguish between a grossly visible lumen and microscopic channels.

Studying the organizing thrombus, one sees the capillaries develop *pari passu* with the fibroblasts (Fig. 12). By the time the fragmentation has been rendered quite complete, the capillaries have fused into sizable communicating channels. In so doing they push aside both the organized thrombus and valve fragments.

The vein, at the valve site, assumes an appearance which differs not at all from the thrombosed vein at any non-valved part (Fig. 13). The vein wall is thickened by the addition of fibroblastic tissue, and its lumen is crossed by columns of the tissue, separated by the endothelium-lined clefts. These columns gradually become thinner by virtue of the shrinkage of the maturing connective tissue, and by the corresponding increase in size of the intercommunicating blood channels. Staining for elastic tissue demonstrates this material of valvular origin, lying within the connective tissue strands (Figs. 6, 7, and 8). This finding demonstrates conclusively that the segment of vein under scrutiny is actually one which previously contained a valve, for the valve cusps are the only available intramural source of this material. New elastic tissue does, indeed, form in the connective tissue, but only after many weeks, and then it is very much finer in texture and paler in staining quality.

The end result of the recanalization is the production of a valveless single lumen in the vessel. The lumen, as noted, may be large and therefore clinically important,—or small, and recognizable only by microscopic examination. In those instances in which the valve has very early become adherent to the vein wall, the vessels may more easily traverse the thrombus

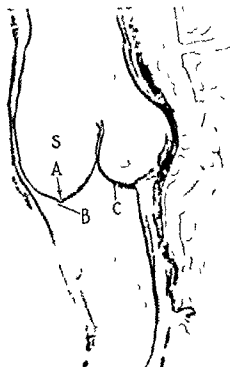


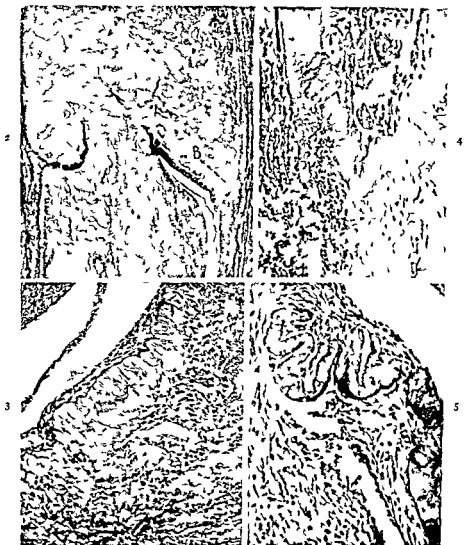
Fig. 1 The human venous valve in fresh, unshrunk condition, longitudinal section. S, Sinus, A, angle, B, base, C cusp (contact surface). (From Surg., Gynec. & Obst., 1934, 59, 916.)

and may not break the valve up so completely. In such a case, a sizable sheet of its elastic tissue may be found in the thickened intima, lying parallel to the older vein wall (Fig. 6).

INCOMPLETE OR PARIETAL THROMBOSIS

Several examples were obtained of the effect of parietal thrombosis on the valve, although we did not demonstrate the sequence in as much detail as in the case of complete thrombosis. The early changes are very similar to those in complete thrombosis, the valve base shows the same dilatation and proliferation of the capillaries and splitting of the junction of the elastica.

The sinus is apt to be well filled with clot from the start. Organization here produces a pad of tissue which narrows the lumen of the vessel (Fig. 14). The cusp will be adherent to this connective tissue for a variable distance, from the angle to its free edge, and indeed may be quite lost within this new intima (Fig. 9). Laterally, in the commissure of the valve, the cusps may become adherent to each other by interposition of fibroblastic tissue (Fig. 14).



Figs 2 to 5 Photomicrographs in experimental complete thrombosis in the dog

Fig 2 A longitudinal section of a femoral vein showing both valve cusps in the organizing thrombus 7 days $\times 17$

Fig 3 The detail of the valve base at B of the preceding figure. New capillaries cross the junction of the elastica. The contact surface of the cusp is covered by a thin layer of organized thrombus next to a still intact elastica. The angle is filled with vascular connective tissue binding the cusp to the vein wall. The fibroblasts enter into crevices of the cusp $\times 110$

Fig 4 Septic phlebitis. There is ulceration of the valve base 6 days $\times 145$

Fig 5 The free edge of a cusp which has folded on itself and become surrounded by the connective tissue of the thrombus 8 days $\times 145$

In addition to the possibilities of adhesion the cusp is subjected to further change by the growth of fibroblasts more generally over its two surfaces. Through the addition of this tissue the cusp becomes thickened, and therefore more or less rigid, and through the con-

traction of this tissue it becomes linked and shortened so that it meets its fellow with difficulty or not at all. Such a cusp projecting rigidly into the lumen will hinder the centripetal flow of blood and will be more or less ineffectual in preventing back flow. It can



Figs 6 7 and 8, Photomicrographs in experimental complete and Fig 9 incomplete thrombosis in the dog

Fig 6 Recanalization has broken up the thrombus, leaving trabeculae crossing the lumen. In one of these at C_1 is a small piece of elastic tissue, a remnant of the previously existing valve. At C_2 is a longer strip representing the second cusp. The dark areas in the heavier trabeculae below are nuclei in the newly formed connective tissue, and pigment in macrophages. 4 months, $\times 22$.

Fig 7 Further recanalization has resulted in a single, narrow lumen. The vein is now valveless. 7½ months, $\times 37$.

Fig 8 Detail at area C of the vein shown in Figure 7. There is still evidence of a previously existing valve cusp in the shred of elastic tissue buried in the thickened intima. $\times 250$.

Fig 9 The cusp is adherent to the vein wall by connective tissue which lies along the whole of its sinus surface. Its free edge is thickened and linked by this tissue. 13½ weeks $\times 45$.

therefore be said to exhibit stenosis and insufficiency comparable to that shown by the mitral valve (Figs 15, 16)

As in complete thrombosis, the cusp will be less disrupted if it lies laterally (open) at the moment of thrombosis, and in this position



Figs. 10 to 13. Complete thrombosis in man.

Fig. 10. Femoral vein longitudinal section. The cu p lies imbedded in the organizing thrombus. The sinus is filled with maturing connective tissue which effects adherence of the cu p to the wall. There is some kinking of the cusp maintained by the new tissue as well as shortening which is evidenced by wrinkling of the elastica in its mid portion. $\times 111$.

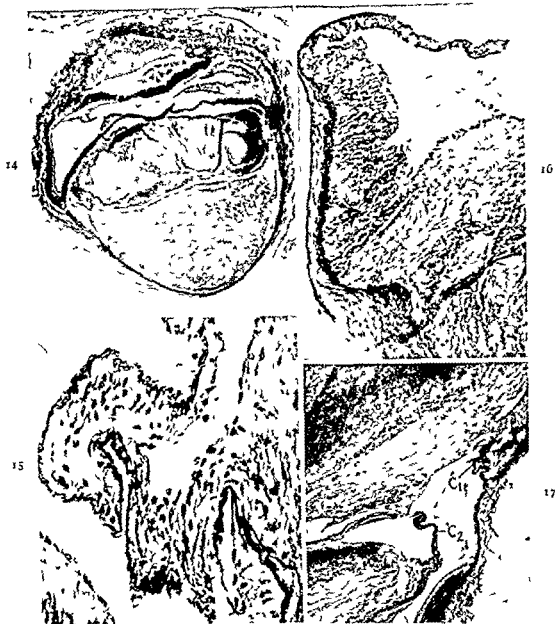
Fig. 11. Detail at valve base of an iliac vein cross section. The structure is disrupted by newly formed capillaries, lymphocytes, and fibroblasts. $\times 165$.

Fig. 12. Detail of the mid portion of the same cu p shown in Figure 11. The cu p is wrinkled and folded on itself, this distortion being maintained by fibroblasts. In some areas capillaries and fibroblasts enter crevices in the tissue of the cu p. $\times 100$.

Fig. 13. Complete thrombosis of a saphenous vein and incomplete thrombosis of its tributary artificially induced 10 weeks. The main vein shows the enlargement of the valve sinuses but the cu ps have been destroyed. Under higher magnification some of the valve elastica can be found at areas indicated. The valve of the tributary T is involved in an incomplete thrombosis. $\times 105$.

may become imbedded within the new thick intima or adherent to it (Fig. 9)

When a vein is completely thrombosed, its tributaries may exhibit a panarterial thrombosis



Figs 14 to 17 Incomplete thrombosis in man

Fig 14 Femoral vein cross section. The larger sinus is completely filled with clot, more than half of which is organized. When it is all organized, it will make permanent the banding of the valve to the vein wall. The other sinus is less completely filled with organized thrombus, but enough to limit the lateral excursion of the cusp. This cusp is further hampered in its movement first by a thickening due to the organization of the thrombus along its contact surfaces, and second by inter adhesions between it and its fellow at one commissure. Not only is this valve completely hampered in its closure (in sufficiency) but as the cusps are projected rigidly into the lumen, they seriously obstruct the flow of blood (stenosis). This stenosis is further augmented by the adhesions between the two cusps. $\times 13$

Fig 15 One cusp from the tributary of the vein shown in Figure 13. The cusp is thickened by the addition of fibroblasts. It also presents a kinking and shortening, maintained by these cells. $\times 235$

Fig 16 One cusp from a saphenous vein (operative specimen). The structure is thickened and shortened by the addition of connective tissue especially on its sinus side. Here the connective tissue effects an adhesion of cusp to wall. Compare thickness of proximal half of cusp to that of terminal uninvolved portion. $\times 76$

Fig 17 A special variety of incomplete thrombosis: the valve of a vein tributary to a completely thrombosed femoral vein. The intima of the tributary is thickened. Both cusps are caught in the organizing thrombus of the parent trunk. Cusp C₁ is entirely incorporated in new tissue, C₂ pulled back by adhesion of free edge. $\times 215$

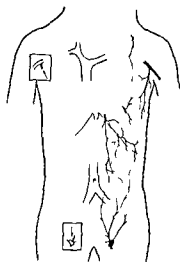


Fig 18

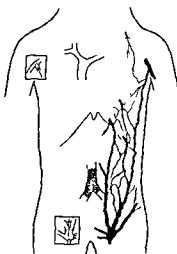


Fig 19

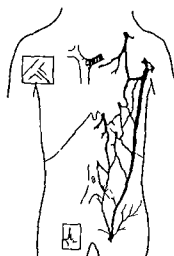


Fig 20

Fig 18 Normal venous drainage of the anterior wall of the trunk. The inserts in the rectangles indicate the direction of the blood flow above and below the umbilicus. This direction of flow is ensured by the presence of valves in these veins.

Fig 19 The direction of venous flow when the veins of the trunk act as collaterals in obstruction of the inferior

vena cava or its main tributaries. The flow takes place against the direction of the valves in the lower veins.

Fig 20 The direction of venous flow when the veins of the trunk act as collaterals in obstruction of the superior vena cava or its main tributaries. The flow takes place against the direction of the valves in the upper veins. This is made possible by an insufficiency of these valves.

The cusps at the mouths of such tributaries may be involved in such fibroblastic adhesions as have already been described. They may, however, show a special form of crippling due to their being caught in the thrombus of the parent trunk. The entire cusp may thus be caught and will go through the same destructive process as any cusp lying within a complete thrombus. A variation of this process is the adhesion of only the free edge of the cusp to the thrombus of the parent trunk. The section of such a valve shows its cusps pulled far back from the axis of the lumen in such a way as to render the valve absolutely useless (Fig 17).

Occasionally only one cusp is thus caught while the second may be free. The end stage of such a process is the functional disappearance of one cusp with a resulting incompetence.

THE VALVES OF THE COMPENSATORY COLLATERALS

In the preceding discussion it has been stated that some recanalization always occurs although in some cases it results in only a microscopic lumen in the phlebotic vein. Such

a lumen is inadequate and the blood in its return to the heart must pass through the normal collaterals. These collaterals, especially when they are few in number, are forced to dilate to accommodate a larger volume of blood than they normally carry. When they are deeply placed, these compensatory collaterals are supported by the deep fascia, and dilate only enough to handle their increased blood content.

In a previous work (5) the length of the valve cusp that is actually in contact with its fellow was measured, and found to be from 0.2 to 0.5 of the diameter of the vein as measured across its center at right angles to the cusps. Taking into account the fact that there are two cusps, it is seen that they cannot meet, as soon as the vein has dilated an equivalent to from 0.4 to the whole of the original diameter (Fig 1).

If we consider that the deep collaterals, when they are compensatorily dilated, measure two or more times their original diameter, then it is evident that the valves of such collaterals are incompetent. This is analogous to incompetency of an aortic valve when

syphilis causes a dilatation of the aortic ring. The superficial compensatory collaterals are not supported by a firm fascia and dilate beyond their needs for blood carrying. In superficial collaterals, therefore, the valvular incompetence is apt to be even more marked than in the deep veins.

This valvular incompetence is evident on inspection of the veins lying on the anterior wall of the trunk, when they are dilated compensatory to a phlebitis of a vena cava, or a femoral or iliac vein. These superficial veins are divisible into two groups (Fig. 18) those above the umbilicus, which drain into tributaries of the superior vena cava via the internal mammary, intercostal, and long thoracic veins, and those below the umbilicus, which drain into the tributaries of the inferior vena cava via the superficial epigastric, circumflex iliac, and pudendal tributaries of the saphenous vein.¹ These two sets of veins are supplied with valves which direct the blood coming from below the umbilicus downward, into the upper end of the saphenous vein, and the blood from above the umbilicus upward, into the veins tributary to the superior cava.

Whenever there occurs a thrombosis of the inferior cava, or the iliac or femoral veins, with inadequate recanalization, these surface veins dilate, and act as compensatory collaterals. The ability of these veins to act thus depends upon a preliminary dilatation of the vein, with a resultant valvular incompetence, for the blood in the inferior group of veins must now run upward against the direction of the valves. This reversal of blood flow does, indeed, take place (3), and it can be demonstrated by inspection or by roentgen ray visualization (Fig. 19). An analogous situation obtains when there has been obstruction to the superior vena cava or its tributaries (Fig. 20).

On the few occasions when we have been able to examine such collaterals at operation or postmortem, we have not been able to locate the valves of these veins. They evidently undergo a process of degeneration, the mechanism of which we are not ready to explain.

¹Medially the para umbilical veins, and laterally the lumbar veins constitute a functional potential channels.

SUMMARY AND CONCLUSIONS

Phlebitis, with the organization and recanalization of its attendant thrombosis, has a profound effect on the valves of the involved veins.

Complete thrombosis produces, actually or functionally, a valveless vein. Should the cusp be projecting into the lumen (closed position) at the time thrombosis occurs, it lies in the very center of the organization process. Here it is a passive structure, fragmented by hemorrhage and inflammatory exudate, made adherent to the vein wall at the sinus, and to its own folds and to its fellow cusp, and traversed by capillaries and fibroblasts. As organization proceeds, the capillaries widen and coalesce, constantly increasing the fragmentation of the cusp. By the time the capillaries have formed sizable channels, the cusp is no longer existent. Only fragments of its elastic tissue can be found in the trabeculae which separate the lumina. When, finally, there is produced a single lumen, only occasional traces of this elastic tissue can be found in the irregularly thickened intima, to mark the site where the valve previously existed.

Should the cusp be near the wall at the moment of thrombosis (open position) the earliest organization binds it to the intima. Here the later changes of organization and recanalization disrupt it less than in the former case. But this vein is functionally just as valveless, since the cusp can no longer project into the lumen.

In the case of incomplete, or mural thrombosis, there may result changes in the cusps, comparable to stenosis and insufficiency seen in the heart valves. Fragmentation of the cusp is minimal and usually limited to the base. More important, however, is the addition to the cusp of new connective tissue, which binds its proximal part to the vein wall, and thickens and shortens it along some, or all of its length.

Stenosis may also be occasioned by the organization of the thrombus in the valve sinus, producing a pad of tissue which does not allow the cusp to open widely.

As in complete thrombosis, the cusp may be rendered functionless by adhesion of its entire length to the vein wall.

A special form of adhesion with resultant insufficiency is seen in the valve guarding a tributary, which leads into a vein undergoing complete thrombosis. In this case one or both cusps may be caught in the thrombus of the main trunk, by the free edge or in the entire length. The organization will destroy these cusps, or pull them far apart and maintain them in a constant open position. Such a condition is exemplified in the valves of the perforating veins of the leg when a thrombus involves the deep veins.

When recanalization does not proceed sufficiently to form an adequate lumen, the collateral veins dilate to take over the blood flow. Such dilatation produces a necessary insufficiency of the valves of these collaterals. This is exemplified in the veins of the trunk when there is an occlusion of either vena cava.

We feel that in these studies we have found at least one of the reasons which is responsible for the poor venous circulation which follows phlebitis.

It is a pleasure to acknowledge the help and advice given us in this study by Dr. Fredenc Parker Jr.

REFERENCES

1. BENDA, C. In Aschoff's Lehrbuch der Pathologie, Ed. 2 1911.
2. BENKE, R. Die Ursachen der Thrombusorganization. Beitr. z. path. Anat. u. z. allg. Path., 1890 7 95.
3. EDWARDS, E. A. The treatment of the recurrent varicose ulcer. New England J. Med., 1935 213 450.
4. Idem. The orientation of venous valves in relation to body surfaces. Anat. Rec., 1936 64 369.
5. Idem. The treatment of varicose veins: anatomical factors of ligation of the great saphenous vein. Surg., Gynec. & Obst., 1934 59 916.
6. HOMANS, J. The operative treatment of varicose veins and ulcers, based upon a classification of these lesions. Surg. Gynec. & Obst., 1916 22 143.

SKIN HYPERESTHESIA IN ACUTE SALPINGITIS

JOHN S. LABATE, M.D., New York, New York

SKIN hyperesthesia has been almost entirely neglected in gynecology. Skin sensitiveness is known to occur in acute inflammations of some of the abdominal organs, notably the appendix and gall bladder. It is reasonable to assume that hyperalgesia may be associated with acute inflammations of the fallopian tubes also. Accordingly, a large series of cases of acute salpingitis, as well as other pathological conditions of the internal female organs have been studied to determine the frequency and exact distribution of skin hyperesthesia.

A review of the literature readily discloses the meager knowledge concerning the occurrence of skin hyperesthesia in diseases of the female internal genitalia. Robinson (1908) cites 4 cases of salpingitis and pyosalpinx and 1 case of ruptured ectopic gestation which failed to show skin hyperalgesia. Cope (1924) presents 4 cases of salpingitis associated with a "certain amount of pelvic peritonitis," 2 of which showed skin hyperesthesia. Two cases of inflamed ovarian cysts also reported by Cope showed a "small area of hyperesthesia." Livingston (1932) reports having observed 4 cases of acute tubal conditions with definite hyperalgesia. Pottenger (1922), in his text *Symptoms of Visceral Disease* merely mentions that the skin may become sensitive in some affections of the ovary. Sherren (1903) and Ligat (1919) in their observations on cutaneous hyperesthesia fail to mention any pathological condition of the female genitalia which may show changes in skin sensitivity.

The paucity of observations on skin hyperesthesia in affections of the female pelvic organs is apparent. Obviously many errors are still made in differentiating acute inflammatory conditions of abdominal organs, particularly the appendix, from acute tubal affections or ectopic tubal gestation. Studies on the frequencies but above all the exact

distribution of skin hyperesthesia in disorders of the fallopian tubes may afford another clue in the differential diagnosis.

Innervation of the fallopian tubes 1 *Efferent neurones* The motor fibers to the tubes are derived from the ovarian plexus and the uterovaginal plexus. Nerves to the ampulla are given off from branches of the ovarian plexus passing to the ovary while those to the isthmus come from the uterine branches of the uterovaginal plexus (Morris and Jackson). The ovarian plexus arises from the intermesenteric and renal plexuses overlying the abdominal aorta. The ovarian plexus then continues downward into the pelvis closely following the course of the ovarian vessels. Besides supplying the ovary it sends fibers to the fallopian tubes and broad ligament and communicates with the uterovaginal plexus within the broad ligament (Kuntz, personal dissections).

2 *Afferent neurones* The afferent fibers pursue 1 course similar to the efferent nerves with the exception of a detour via the posterior roots to reach the sensory nerve cells in the posterior root ganglion. The afferent fibers from the ovary traveling along the ovarian plexus reach the cord at the level of the tenth thoracic segment. Kuntz believes that the afferent fibers from the uterus and tubes run through the superior hypogastric plexus (presacral nerve). However, recent experiments on the course of the sensory nerves of the ovarian plexus in the cat show that afferent fibers from the tubes also course through the ovarian plexus (Labate and Reynolds—1936). The afferent fibers from the isthmus portion probably follow the course of the efferent fibers through the superior hypogastric plexus.

It is generally believed that the afferent fibers from the tubes enter the cord at the levels of eleventh dorsal to first lumbar segments (Kuntz and others). The distribution of skin hyperesthesia in acute salpingitis, as will be reported in subsequent paragraphs,

From the Department of Obstetrics and Gynecology, New York University College of Medicine and the Gynecological and Obstetrical Service, Bellevue Hospital, Third Surgical Division. W. E. Studdiford, director.

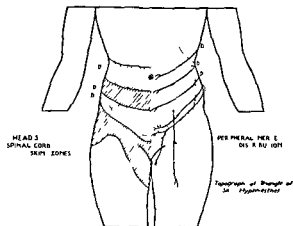


Fig. 1. Relation of topographical triangle of skin hyperesthesia to the areas of distribution of Head's cord segments involved in tubal diseases. The distribution of peripheral sensory nerves is shown on right and Head's skin zones are depicted on the left.

includes the surface of the abdomen corresponding to the cutaneous distribution of the pain fibers issuing from the tenth dorsal. This may be due to a process of diffusion of skin tenderness. But since, as mentioned, afferent fibers from the tubes have been found to run in the ovarian plexus, it may be possible that some of the afferents from the tubes also enter the cord at the tenth dorsal.

Cutaneous sensory distribution corresponding to the tenth dorsal to first lumbar. Head (1893) marked the whole of the body and limbs into areas each of which corresponded to the "cutaneous distribution of the pain fibers given off from one segment of the cord." Figure 1 illustrates the areas of cutaneous distribution of the pain fibers given off from the segments of the cord from tenth dorsal to first lumbar which are involved in affections of the fallopian tubes. The areas corresponding to the cutaneous distribution of the pain fibers given off from the tenth dorsal and first lumbar segments are found to involve the entire lower abdomen and a portion of the upper part of the thigh (Fig. 1). Actually, however, the areas are never found to be so sharply delimited.

Subsequent writers have altered this distribution. Thus Head's first lumbar region corresponds more closely to that which Thorburn and others have assigned to the second lumbar. Anatomical dissection has shown that

the first lumbar is mainly distributed above the line of Poupart's ligament, where Head has the twelfth dorsal and that only a portion of its area lies below the ligament on the front and inner side of the thigh. Finally Thorburn places the umbilicus no higher than the lower part of tenth dorsal. Rudinger shows the umbilicus at eleventh dorsal, Quain between the tenth and eleventh dorsal, Schwalbe opposite tenth dorsal and Patterson claims it lies between the tenth and eleventh dorsals (as quoted by Thorburn).

MacKenzie (1893) contradicted Head's sharp delimitation and claimed that reference of pain was along the course of peripheral nerves "whose root was in intimate association with the root of the sympathetic nerves that supplied the affected organ." Thus he explained the overlapping of sensory fields since he noted that "in very few of the cases could the field of hyperesthesia be delimited with certainty." Ligat (1919) also found that the "hyperalgesia was never distributed evenly over any one segmental area." In the present study, maximal points of tenderness and skin hyperesthesia were observed but no complete limitation according to Head's segmental zones.

Theories concerning the production of skin hyperesthesia. Skin hyperesthesia is an altered response to stimulation of the skin surface due to some disturbance within an internal organ. It is produced through a viscerosensory reflex, the afferent component being situated within the disturbed viscus. Ross in 1888 elaborated his theory of referred pain which is similar to the so called MacKenzie theory, but insisted on the presence of visceral (splanchnic) pain. Studies of viscerosensory phenomena were made independently by MacKenzie (1893) and Head (1893). The former elaborated the theory that viscerosensory phenomena were due to an overflow of sensory impulses from the sympathetic afferent component to involve certain cerebrospinal sensory roots with which it comes in contact within the central nervous system. "If we consider that a stimulation arises in an organ and is transmitted by afferent nerves to a more central situation and if this stimulation be of sufficient force or of the proper quality to affect certain nerve roots with which it comes in contact, then,

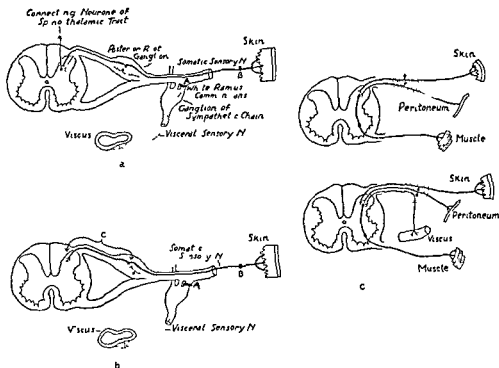


Fig 2 a, Mechanism of referred pain, the Ross-MacKenzie theory Afferent impulses pass through the visceral sensory neurone by way of white ramus communicans to connecting neurone of the spinothalamic tract and are interpreted by higher centers as coming from somatic sensory nerve which also connects with the spinothalamic tract Visceral pain may be interrupted by blocking nerve at A But this theory fails to explain how a block at B relieves pain (After Woodbridge from LeMaire)

b Mechanism of referred pain, the Edinger LeMaire theory Portion C of the somatic sensory nerve is supposed to be interpolated in the course of afferent visceral impulses LeMaire assumes that a block at B affects the proximal as well as visceral portion of the somatic sensory nerve and so stops transmission of afferent visceral impulses at C (After Livingston from LeMaire)

c Relation of afferent fibers from the parietal peritoneum and from the viscera in the causation of localizing abdominal signs and symptoms (After Livingston from Morley)

according to the function of the nerve root there will arise phenomena peculiar to the organ stimulated" (MacKenzie) (Fig 2, a)

Head presented his ideas of referred pain as being due to an irritable focus within the spinal segment set up by a bombardment of afferent impulses from the disturbed viscus "Then," states Head, "a stimulus applied to the skin over the area supplied by the nerve roots belonging to this segment will be exaggerated and a stimulus which normally perhaps was only uncomfortable would now appear very sensitive"

LeMaire (1926) believes that an actual synapse occurs within the dorsal root ganglion between the visceral and somatic afferent neurones From this point of union the stimulus is then carried centrally from the dorsal root along a common pathway (Fig 2, b)

Finally Morley (1931) states that pain resulting from visceral disease is referred to a somatic cutaneous area only when the parietal peritoneum is involved (Fig 2, c)

METHOD OF STUDY

Every patient admitted to the gynecological wards of Bellevue Hospital with an admission diagnosis of salpingitis through a period extending from July to December, 1935, was examined carefully for skin hyperesthesia

a Technique Skin hyperalgesia can be elicited accurately only if a proper and adequate stimulus is applied Various methods are available for testing for skin tenderness Robinson (1908) and Cope (1924) pinched lightly very small portions of the skin with the finger tips and stroked the abdomen with the head of a common pin Sherren (1903) gently

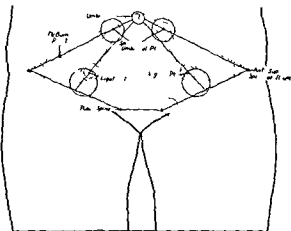


Fig. 3. Composite drawing of different areas of skin hyperesthesia found in acute salpingitis. The bands and circles between and around the spino umbilical and Ligat points are the sites most frequently involved and the sites of maximal skin hyperesthesia. Note the extent of skin hyperesthesia into the thighs which occurred in 0 cases.

stroked the skin. Ligat grasped the skin and subcutaneous tissues between the finger and thumb and applied traction from the deeper layers of the abdominal wall. Livingston used a vigorous pinch of sufficient intensity to produce discomfort on normal skin. The use of heat and cold or deep scratching with a dull instrument are other methods which may be used.

The milder forms of testing, such as stroking the skin with a dull instrument, heat and cold, and light pinch, were used early in this study but were found to be inadequate. An adequate stimulus must be applied in order to elicit skin hyperesthesia accurately. Therefore, we combined traction with a vigorous twist. The skin and subcutaneous tissues were grasped between the thumb and forefinger, care being exercised not to exert any downward pressure on the deeper structures. The skin was then pulled straight out simultaneously exerting a vigorous twist. A preliminary stimulus of a similar nature was applied first over an uninvolved area of the skin to determine the patient's pain threshold. This initial pull was used as a standard of intensity and pulls of equivalent intensity were used over the entire abdomen. Every part of the abdomen was tested carefully beginning over uninvolved areas and systematically working toward the area of sensitiveness. Thus the total area of

TABLE I—SKIN HYPERESTHESIA IN ACUTE SALPINGITIS

Cases	Positive				Slight or absent		Per cent
	Frequent		Moderate				
	No	Per cent	No	Per cent	No	Per cent	
55	26	40	15	24.3	12	22.7	77.5
Skin hyperesthesia in mild (subacute or chronic) salpingitis							
10	4	40	5	50	4	40	60.00
Skin hyperesthesia in tubo-ovarian abscess							
8	0		0		0		0
Skin hyperesthesia in pelvic cellulitis							
3	1		1		0		

hyperalgesia was mapped out at the same time noting the points of maximum sensitivity.

A parallelogram was outlined on the abdomen of every patient. A line was drawn from the umbilicus to the anterior superior spine of the ilium. Another line connected the anterior superior spine of the ilium with the spine of the pubis. The process was repeated on the side opposite (Fig. 3). Within this diagram McBurney's and Ligat's points were plotted. The relation of the areas of maximal skin hyperesthesia to the fixed points corresponding to the umbilicus, the anterior superior spine of the ilium, and the spines of the pubis were studied accurately in each patient.

b. Evaluation of the sign. The elicitation of pain was used as the criterion of increased sensibility. Only when traction of the skin caused definitely demonstrable discomfort as evidenced by wincing of the patient or by her attempt to brush away the examiner's hand was any credence placed on the sign. Skin hyperesthesia was considered positive only when unquestionably present. Slight or questionable response was considered negative.

The following factors may confuse the interpretation of skin hyperesthesia: (1) There is a certain amount of discomfort when the skin over the abdomen is pulled normally. (2) Extreme deep tenderness will cause the patient to cry out with pain unless extreme care is taken to grasp only skin and subcutaneous tissues. (3) Distention makes it difficult to pick up the skin without exerting downward

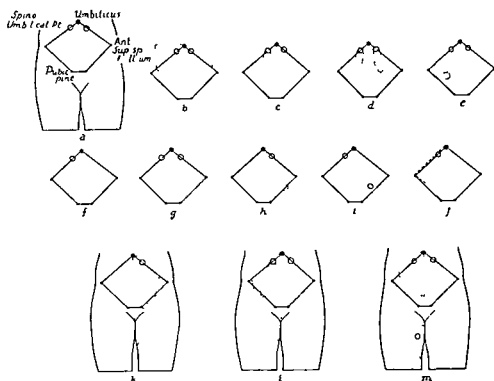


Fig 4 Various combinations of skin hyperesthesia with maximal areas at the spino umbilical point The dark circles signify areas of maximal hyperesthesia and the areas within the dotted lines denote total distribution of skin hyperesthesia

pressure on deeper structures (4) Obesity makes accurate localization of skin hyperesthesia more difficult because only large areas of the skin can be grasped at one time (5) The hyperesthetic patient will cry out or complain even when no real hyperesthesia is present (6) Tender and enlarged inguinal lymph nodes will give a false positive sign and the area of maximal hyperesthesia may be falsely localized here

RESULTS

a Skin hyperesthesia in acute salpingitis

Fifty-three patients with acute salpingitis were examined and of these 26 or 49 per cent showed exquisite skin hyperesthesia while 15 or 28.3 per cent had moderate hyperesthesia. Thus 77.3 per cent of the patients showed positive skin hyperesthesia. In the 12 remaining or 22.7 per cent skin tenderness was not elicited (Table I)

The total extent of skin hyperalgesia varied markedly in individual cases. In 77 per cent of the positive cases hyperalgesia was bilateral, but symmetrical areas were not necessarily involved. Hyperesthesia occurred either over a wide area involving one or both lower quadrants or, as happened most frequently, over

small zones involving only segments of the lower abdominal cutaneous surface (Fig 3). Figure 3 represents a composite drawing of different areas of the abdomen which may be sensitive in acute salpingitis. The skin surface which may become hyperesthetic will be seen to be quite extensive and may involve all or small parts of the lower abdomen below the umbilicus, internal to the anterior superior spine of the ilium and above Poupart's ligament. The total area of the skin hyperalgesia associated with acute salpingitis may be represented by a quadrangle which is bounded above by a line drawn horizontally from the umbilicus, limited below by Poupart's ligaments and laterally by a perpendicular line drawn internal to either anterior superior spine of the ilium. In a few instances skin hyperesthesia will extend into the thighs. It must be emphasized, however, that this entire area may not be involved and that it may not be equally hyperesthetic throughout. Several areas of maximal skin hyperesthesia are always found. In fact in many of the patients examined skin hyperesthesia was demonstrated only at the so called maximal points (Figs 4 to 6)

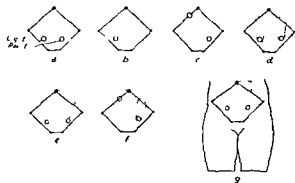


Fig. 5 Combinations of skin hyperesthesia with maximal area at Ligat's point

Table II shows the sites of maximal skin hyperesthesia as determined in this study. The position of the spino umbilical point, is described as an arbitrary point 2.5 centimeters lateral to the umbilicus on a line drawn from the anterior superior spine of the ilium to the umbilicus. The maximal area of skin hyperesthesia was localized at the spino umbilical point in 50 per cent of the positive cases. The skin over this area may become extremely sensitive, a light grasp being sufficient to cause the patient to wince or cry out with pain. Hyperalgesia may diffuse downward from the spino umbilical point in the form of a narrow band as shown in 16.7 per cent of the positive cases. In this connection it is interesting to note that Ligat (1919) stated that spread from the maximal point occurs "in a vertical direction, the hyperesthesia almost always extending further in a downward than in an upward direction."

In 12.7 per cent of the positive cases, the maximal area of skin hyperesthesia was found at Ligat's point. In a smaller number skin hyperesthesia was found to be maximal at the spino umbilical point on one side and at Ligat's point on the opposite side. Table II shows the different areas of maximal skin hyperesthesia that were found (Fig. 7).

Skin hyperesthesia in many cases of acute salpingitis may be demonstrated only at these maximal sites. However, careful examination in many cases may show an associated area of skin tenderness of less intensity which may involve variable portions of the lower abdomen (Figs. 3 to 6). The most acute case of acute salpingitis with high temperature, leuco-

TABLE II—SITES OF MAXIMAL SKIN HYPERESTHESIA IN ACUTE SALPINGITIS

	Cases	Per cent
Spino umbilical point	29	50
Band from spino-umbilical point diffusing down to Ligat's point	8	16.7
Spino umbilical point on one side—band on other	2	4.1
Spino-umbilical point on one side—Ligat's point on other	2	4.1
Band on one side—Ligat's point on other	1	2.07
Ligat's point	6	12.7

cytosis, elevated erythrocyte sedimentation rate, and pelvic peritonitis may fail to develop skin hyperalgesia. Skin hyperesthesia occurring over the described maximal areas particularly at the spino umbilical point is characteristic of acute salpingitis but must not be relied upon solely to make the diagnosis. It must be stated emphatically that the absence of skin hyperesthesia has no negative value. The greatest value lies in the location of the maximal areas of skin sensitivity since in acute appendicitis also, hyperesthesia is found in the right lower quadrant and in ureteral colic hyperesthesia is elicited within the inner surface of the thigh. But in acute appendicitis the area of maximal skin hyperalgesia is at McBurney's point, and in ureteral colic the maximal area will be found in the thigh (Livingston). Acute salpingitis never produces skin hyperesthesia which is maximal at McBurney's point or in the thigh.

A glance at Figure 3 will show that the total area of skin hyperesthesia is represented as extending into the thighs. In 9 cases of acute salpingitis hyperalgesia was observed in the inner aspect of one or both thighs, roughly medial to the sartorius muscle. The sensitive zone was never maximal and usually involved an area 4 to 8 centimeters in diameter at a variable distance below Poupart's ligament. The pressure of the bed clothes on the thighs produced sufficient discomfort to cause these patients to complain on rounds. It is also interesting to note that patients with acute salpingitis often had referred pain along the inner part of the thigh, at times extending as far down as the knee.

Two cases of parametritis, one postabortal, the other postoperative, showed skin hyperalgesia over the inner surface of the thighs. One other patient with parametritis had no skin

LABATE SKIN HYPERESTHESIA IN ACUTE SALPINGITIS

TABLE III —POINTS OF MAXIMUM TENDERNESS IN ACUTE SALPINGITIS

	Unilateral	Bilateral	Total	Per cent
Ligat's point	13	18	31	55.4
Spino-umbilical point	5	7	12	21.4
Ligat's point on one side— Spino umbilical point on other	0	10	10	17.1
Absent maximum tenderness	0	4	4	7.1

hyperesthesia. These cases are mentioned at this time merely to suggest that the presence of skin hyperesthesia over the thighs in acute salpingitis may mean the presence of an associated parametritis, the inflammatory exudate within the broad ligament producing pressure on afferent nerve fibers.

In 55.4 per cent the point of maximal tenderness was at Ligat's point. This is contrary to the location of maximal skin hyperesthesia at the spino-umbilical point in the majority of cases. We may conclude, therefore, that the point of maximal tenderness need not be identical with the point of maximal skin hyperesthesia. In 21.4 per cent deep tenderness was found to be maximal at the spino-umbilical point. In 17.1 per cent maximal deep tenderness was located over the spino-umbilical point on one side and over Ligat's point on the side opposite. No area of maximal tenderness was demonstrated in 7.1 per cent (Table III).

b Skin hyperesthesia in mild (subacute or chronic) salpingitis. Ten patients were observed in this phase of salpingitis. In 4 skin hyperesthesia was exquisite, in 2 moderate, and in 4 no skin sensitiveness could be demonstrated. Hyperesthesia was bilateral in 2 and unilateral in 4. The total distribution and points of maximal skin hyperesthesia were similar to those occurring in the more acute tubal inflammations.

c Hyperesthesia in tubo-ovarian abscess. Eight patients possessing tubo-ovarian abscesses were examined frequently for skin hyperesthesia. In none of the patients could hyperesthesia be demonstrated. The absence of skin hyperesthesia in these patients may be due to the prolonged destructive process of the inflammatory exudate which must involve the terminal endings of the nerves. Anyone fa-

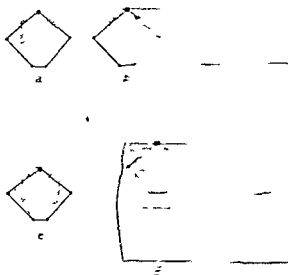


Fig. 6. Combination of skin hyperesthesia in the pelvic area as a spino-umbilical point.

milar with the tubo-ovarian abscess will be advanced destruction of the peritoneum. If, as Ligat has shown, viscerosensory reflex hyperesthesia shows cases

d Skin hyperesthesia in conditions of the female. patients with ectopic pregnancy examined for skin hyperesthesia. In cases with external liberation of blood into the peritoneum one showed any area of hyperesthesia. In one patient where the broad ligament, and pelvic hematoma, and hyperesthesia was elicited. For hyperesthesia in this case was escape of blood into the broad ligament with release of afferent nerve fibers.

Here we should consider differential diagnosis of skin hyperesthesia in salpingitis rather than hyperesthesia in acute salpingitis. Hyperesthesia is a diagnosis of

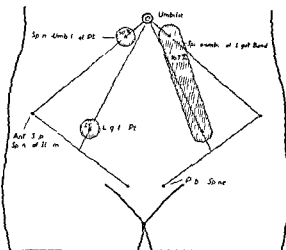


Fig. 7. Graphic representations of various points of maximal skin hyperesthesia found in acute salpingitis. Note the order of frequency of the maximal sites. In 16.7 per cent the area of maximal skin hyperesthesia was present as a band connecting the spino-umbilical point and Ligat's point.

there was a positive skin hyperesthesia the patients were operated upon and acutely inflamed tubes were found at operation. In no patient showing positive skin hyperesthesia was an ectopic pregnancy demonstrated at operation.

Why skin hyperesthesia fails to appear in cases of tubal gestation is not easy to understand. Two possibilities come to mind: (1) An ectopic pregnancy produces a localized swelling 3 to 4 millimeters in length localized in one small portion of the tube. This results in stimulation of only a few of the afferent nerve endings which may be insufficient to produce reflex reaction. On the other hand the inflammatory reaction in acute salpingitis is widespread involving the entire tube. (2) Implantation of the ovum within the mucosa with subsequent development and destructive tendencies of the chorionic tissue results in early destruction of the mucosa. Thus with the destruction of the mucosa the reflex arc is destroyed. Ligat (1919) considered the origin of the viscerosensory reflex as lying in the mucosa.

Additional cases of ectopic pregnancy are being studied at the present time to prove more conclusively the persistent negative hyperesthesia findings. The results of this

study will be reported in detail in a subsequent paper.

Four cases of ovarian cysts, 1 case of endometriosis, 3 cases of intra uterine gestation, 3 incomplete abortions, and 1 carcinoma of the ovary, failed to show any hyperalgesic areas. Eight cases of uncomplicated uterine fibromyomas likewise showed no skin hyperesthesia. However, when an associated salpingitis was found, skin hyperesthesia occurred. Thus of 3 cases of fibroids complicated by salpingitis, 2 showed exquisite skin hyperesthesia over areas typical for salpingitis.

IMPRESSIONS

Skin hyperesthesia when present will be found if proper care is exercised. An adequate stimulus must be applied properly and sufficient time and care should be taken to determine the exact location of maximal skin hyperesthesia. It is at times difficult to choose between the spino-umbilical point and Ligat's point as the maximal area of skin hyperesthesia. At one time the one point will be found maximal, but returning a few minutes later or next day the other point will be found to be maximal. On a number of occasions, also, the maximal area of skin hyperesthesia can be determined only as a band diffusing in a downward direction from the spino-umbilical point.

The following incidences may be cited which subtract from the actual value of skin hyperesthesia as a sign. Hyperesthesia was demonstrated in several patients who were thought to have no disease of the adnexa. In 1 other case a diagnosis of ectopic pregnancy was made, but operation failed to show any demonstrable pathological condition of the tubes or elsewhere to account for patient's symptoms. This patient showed definite skin hyperesthesia. On the other hand several patients were observed with the pre-operative diagnoses of ectopic pregnancy and skin hyperesthesia was noted. At operation subacute or chronic salpingitis was disclosed, a finding which explained the presence of hyperesthesia.

In summarizing the impressions gained during this study, skin hyperesthesia, as related to pelvic inflammatory conditions,

may be said to have the following characteristics

1 Skin hyperesthesia may be entirely absent in the most acute case of salpingitis with elevation of erythrocyte sedimentation rate, leucocytosis, pelvic peritonitis, and severe pain patient may persistently fail to develop hyperesthesia. Thus the presence of skin sensitiveness cannot be used in gauging the severity of the infection. Also the absence of skin hyperesthesia has absolutely no negative value. However, it may be stated that all patients having the initial attack of acute salpingitis consistently showed skin hyperesthesia with the maximal areas at either of the previously described zones

2 Skin hyperesthesia may be of fleeting character. It may be present on admission and gone in a few hours or by the next day to return at some later time or never to return. It may be absent on admission but on examination a few days later skin sensitivity may be found. It is difficult to explain this characteristic of skin hyperesthesia. It seems to bear no relation to increase or decrease in the severity of the infection. Many of the patients show this fleeting type of skin hyperesthesia

3 The persistent type of skin hyperesthesia which is present on admission and remains throughout the acute phase of the disease is also encountered. As the patient is examined daily, hyperesthesia will be found. Many times the maximal area of sensitiveness shifts between the spino-umbilical point, Ligat's point or a band connecting these two points. In this type as the patient improves, the hyperalgesia will tend to disappear, only to recur again with an exacerbation of the disease. The total duration of skin hyperesthesia in these patients varied between several days to 26 days

4 The maximal area of skin hyperesthesia bears no relation to the maximal area of deep tenderness except in some cases. Therefore, one must not predict the area of maximal skin hyperalgesia according to the location of maximal deep tenderness

5 The total area of skin hyperesthesia is variable, rarely very severe, and determined only with the exercise of diligence

6 A maximal area of skin sensitiveness can always be determined. The location of this point offers sufficient aid in the diagnosis, since in acute appendicitis maximal skin hyperesthesia occurs at McBurney's point, whereas in ureteral colic it will be found in the inner portion of the thigh within the urogenital triangle

CONCLUSIONS

1 Fifty-three cases of acute salpingitis were examined frequently and 77.3 per cent showed the presence of skin hyperesthesia

2 Of 10 cases of mild subacute or chronic salpingitis 60 per cent showed positive skin hyperesthesia

3 All patients with tubo ovarian abscess persistently failed to develop skin tenderness

4 The maximal area of skin hyperesthesia in acute salpingitis can always be determined. This may occur at the spino-umbilical point (50 per cent) or at Ligat's point (12.7 per cent). Frequently (16.7 per cent) skin tenderness is found to diffuse downward from the spino-umbilical point in the form of a band

5 Skin hyperesthesia occurring over the above maximal areas is characteristic of acute salpingitis but must not be relied upon solely in making the diagnosis

6 The absence of skin hyperesthesia in acute salpingitis has no negative value

7 Of 12 cases of ectopic tubal gestation 11 failed to show the presence of any skin hyperesthesia. The presence of skin hyperesthesia favors the diagnosis of salpingitis. In only one case in which a broad ligament hematoma was formed could any skin hyperalgesia be elicited

8 The presence or absence of skin hyperesthesia cannot be used to determine the severity of the infection

9 Skin hyperesthesia must be evaluated intelligently. It may be quite fleeting in character or it may be persistently absent in the face of the most severe infection of the tubes

10 The total area of skin hyperesthesia is variable and rarely very severe

BIBLIOGRAPHY

- 1 COPE ZACHARY. Observations on cutaneous hyperesthesia in acute abdominal disease. *Lancet*, 1924, Jan 19

- 2 HEAD HENRY Disturbances of sensation with special reference to the pain of visceral disease Brain, 1893 vol 16
- 3 KUNTZ ALBERT The Autonomic Nervous System Philadelphia Lea & Febiger 1934
- 4 LABATE J S and REYNOLDS S M R Course of sensory fibers of the ovarian plexus To be published
- 5 LEMAIRE A Les perceptions des douleurs viscérales Rev méd de Louvain 1936 No 6 p 81
- 6 LIGAT DAVID Significance and surgical value of certain abdominal reflexes Lancet 1919 1 729
- 7 LIVINGSTON E M A Clinical Study of the Abdominal Cavity and Peritoneum New York Paul B Hoeber Inc 1937
- 8 MACKENZIE JAMES Some points bearing on the association of sensory disorders and visceral disease Brain, 1893 vol 16
- 9 MORLEY J Abdominal Pain New York William Wood & Co 1931
- 10 MORRIS and JACKSON Human Anatomy 8th ed Philadelphia P Blakiston's Son & Co
- 11 POTTINGER F M Symptoms of Visceral Disease St Louis C V Mosby Co 1925
- 12 ROBINSON, HENRY The clinical bearing of cutaneous tenderness on various acute abdominal disorders especially appendicitis Quart J Med 1908
- 13 ROSS J On the segmental distribution of sensory disorders Brain 1888 10 333
- 14 SHERREN J Cutaneous hyperalgesia in appendicitis Lancet, 1903 2 819
- 15 THORNBURN WILLIAM Sensory distribution of spinal nerves Brain, 1893 vol 16
- 16 WOODBRIDGE I D Therapeutic nerve block with procaine and alcohol Am. J Surg, 1930 August 9 p 278

ENTERECTOMY IN THE SURGICAL TREATMENT OF HEPATIC CIRRHOSIS OR PORTAL OBSTRUCTION WITH ASCITES

MURIEL K FULLER, S B, M D, DONALD D MACKENZIE COOK, B A, M B,
OTIS M WALTER, M D, and NICHOLAS ZBITNOFF, M D, Chicago, Illinois

IN THE medical treatment of cirrhosis of the liver with ascites, a high carbohydrate diet has been shown in certain cases to reduce the rate of ascitic accumulation (1). Various drugs have been used, such as salyrgan and merbaphen (novasural), saline and hydragogue cathartics, digitalis and iodides but as E. J. Strode says, in his recent excellent review "the medical treatment of cirrhosis of the liver is most discouraging."

As a palliative treatment paracentesis has been used in the hope of extending the lives of cirrhosis patients. Reports of spontaneous recovery following one or more tapings are noteworthy rare, though Walter Hughson concludes that "probably as many cures have been obtained by its employment as by any other single method." The persistent adherence to the use of paracentesis by internists is justified in that it relieves the patient of the distress and interference with cardiac and pulmonary function, which large collections of ascitic fluid entail. At the same time, as aptly summarized by Hughson, "the failure of surgical treatment to show any uniform degree of benefit has developed a more or less natural hesitancy on the part of the internists to subject their patients to operation."

Hughson says "Consideration of the technical difficulties of performing an Eck fistula on a human being is purely incidental in relation to the inevitably fatal outcome following its successful execution." With care, about one-third of the normal dogs survive the production of an Eck fistula. Many die of septicemia. According to Fischler, two types of intoxication occur following Eck fistula in dogs. The first is due to degenerative necrotic lesions of the liver regularly causing

death preceded by symptoms of manic excitement and ending in coma or convulsions. The second intoxication is that produced by meat feeding and though not necessarily fatal is characterized by blindness, ataxia, muscular twitchings, and excitement. Most authorities hold little hope for the clinical application of the Eck fistula or any of its modifications.

A variety of ingenious surgical procedures for the treatment of ascites have been developed. Some procedures are designed to cause return of the ascitic fluid to the systemic circulation by saphenous venoperitoneostomy (6), some to drain the fluid into the subcutaneous tissues of the abdominal wall by a variety of methods such as the use of collar button like glass cylinders designed by P. Paterson which are fixed in the peritoneum and abdominal muscles, while numerous other attempts have been made to drain the fluid through different parts of the urinary system. In the 25 years that the more bizarre methods have been before the profession they have not gained in favor.

Efforts to treat ascites by the establishment of a collateral circulation have usually taken the form of some kind of omentopexy. This operation, which has come to be known as the Talma-Morison (2, 8) operation, is at present the most popular major surgical procedure in the treatment of ascitic cirrhosis. Writers vary in their evaluation of it. Hughson states "In the present series of 26 cases regarded as correctly diagnosed from either operative or autopsy observations or both, it is impossible to conclude that surgical treatment instituted for the purpose of establishing additional collaterals is of the slightest benefit in portal cirrhosis with ascites," and in evaluating the literature on omentopexy

he concludes "on the basis of correct diagnosis the figure generally accepted as representing the expected benefit from operation, 35 per cent, would fall to approximately 10 per cent, and more careful analysis would undoubtedly reduce the estimate even further"

THEORY

On the theory that accumulation of ascitic fluid in cirrhosis is due in a large part to partial obstruction of the portal circulation in the liver by nodular regeneration of glandular tissue and gradual contraction of increased connective tissue, the hypothesis was developed by Fuller and Cook that obliteration of part of the portal bed by resection of several feet of small intestine might decrease the returning venous blood to an amount which might pass through the cirrhotic liver, thereby decreasing the pressure in the portal veins and capillaries and diminishing the transudation from the portal system into the peritoneal cavity

Of the four important reasons underlying the theory in the development of this procedure, the first (mechanical) is the most obvious, namely that obliteration of part of the portal venous bed by enterectomy will result in a decrease in the amount of portal blood entering the liver

The second (physiochemical) is more hypothetical though based upon Heidenhain's classic experiment in which he demonstrated that hypertonic solutions of crystalloids in an isolated segment of small intestine increased in volume at the expense of water drawn from the intestinal circulation

In this part of the theory we propose the possibility that in the remaining small intestine following enterectomy with the same amount of food and gastric, hepatic, and pancreatic secretions the relatively higher concentration of osmotically active particles present in relation to the surface area of the intestine, should tend toward a slower absorption of water into the capillary blood of the intestinal wall and furnish on the venous portal side of these capillaries a more concentrated blood of less fluid volume. The water content of the feces should be increased. This is reasonable in view of the tendency to

softer stools following massive enterectomies

The third reason takes cognizance of the generally known physiological fact that living membranes become more permeable in the presence of oxygen lack or metabolic waste product increase. In cirrhosis of the liver, because of the slowing of the portal stream, the venosity of the portal blood should be increased. Therefore, any procedure aimed at decreasing the venosity of the portal blood should lessen the permeability of the portal capillaries and other membranes and by furnishing to the liver a less venous blood, increase the chances of regeneration of liver tissue

Fourth, removal of several feet of small intestine changes the ratio of visceral peritoneum to parietal peritoneum. Assuming that the ascitic fluid transudes through the visceral and is absorbed by the parietal peritoneum, removal of several feet of small intestine with its peritoneum should favor absorption of any fluid formed

Three possible procedures were considered (1) removal of from 7 to 12 feet of small intestine, (2) removal of 7 to 12 feet of small intestine and omentopexy at the same operation, (3) intestinal resection and omentopexy at the first operation to be followed by splenectomy if ascites persisted

REPORT OF CASE

In October, 1931, the patient a white male of 36 years awakened one night with chills and fever and noticed in the mirror that his skin was ashen gray. For 2 months he was very weak, had some cough, night sweats, chills and fever. In coughing he raised only a white frothy sputum. In addition to malaise, his appetite was poor, he experienced persistent constipation and between November 1931, and April 1932 he lost 40 pounds in weight. In November, 1931, he weighed 185 pounds and measured 35½ inches around the waist. By April 1932 he weighed 145 pounds and measured 33 inches at the belt line. Between April and May 1932 his weight increased 15 pounds and his belt was let out to 35½ inches, and by July his girth had increased to 38¼ inches and his weight was further increased

By July 1932 his ashen color was not as noticeable, his constipation was not as bothersome because of the use of mineral oil, but he coughed more, raising the same white frothy sputum. He had had no pain, no shortness of breath and no apparent edema, but his clothing seemed noticeably tighter about his abdomen. Late in July, 1932, on slight

exertion he developed shortness of breath and observed that his ankles were swollen.

Physical examination showed a well developed male of apparently his stated age with skin of yellowish gray color. The blood pressure was 90/64 millimeters mercury and the pulse was 120 per minute, but, with bed rest and digitalization, the blood pressure soon became 106/75 and the pulse about 96.

X-ray examination of the chest showed only a slight clouding over the bases of the lungs posteriorly, and a cardiac shadow of questionable to 30 per cent enlargement. Liver function and kidney function tests were within normal range. Guinea pig inoculation with sputum and ascitic fluid was negative. Electrocardiograms showed chiefly a decreased cardiac amplitude. Urine output, on restricted fluid intake, was about 800 cubic centimeters daily, and contained neither sugar nor albumin. The blood picture was normal.

The patient's abdomen continued to enlarge and paracentesis was first performed October 15, 1932, at which time 6.0 liters of ascitic fluid were obtained. On November 4, 1932, he was tapped again and 6 liters was obtained. Sixteen days later November 20 paracentesis yielded 7 liters and again on December 4, 7 liters, and on December 23, 6 liters of ascitic fluid was obtained. In the next 19 months he was tapped a total of 21 times. The maximum accumulation for a single tapping was 20 liters in 90 days, but the patient did not gain in weight from the sixty-eighth to the nineteenth day.

The ascitic fluid showed no change in character during this 19 month period, being of clear amber color with a specific gravity of 1.015 to 1.017 and containing a protein coagulable by heat. There were a few small and large lymphocytes present. No bacteria were ever seen and cultures of the fluid were consistently negative. For the 5 tapplings during the 62 days previous to the operation, the average ascitic fluid accumulation was 0.951 liters daily.

From the onset it was noted that after tapplings the rales over the lungs posteriorly and the edema of the ankles for the greater part disappeared. After each paracentesis for 2 or 3 days the patient could be fairly active with only a slight shortness of breath. However, as the accumulation of ascitic fluid continued, the edema of the ankles returned and the patient resumed his bed or wheel chair existence.

The rapid heart and decreased urine output from the first led to repeated use of digitalis and such diuretics as salyrgan. These and high carbohydrate diets were noteworthy ineffective in altering the rate of ascites formation and for several months prior to presenting himself to us for operation his only treatment had been paracentesis and liberal use of codeine and other opiates.

Pre operative condition. Upon presenting himself to Drs. Walter Zbitnoff, and Fuller for operation, the patient's chief complaint was that of ascites. The edema of his ankles and shortness of breath increased with fluid accumulation and largely disap-

TABLE I—PARACENTESIS RECORD

Date	Number of days accumulation	Number of liters of ascitic fluid obtained at paracentesis	Liters per day
<i>Before Operation</i>			
July 18 1934	27	19	909
August 1	14	13	925
August 15	14	13	928
August 25	10	20	1 000
August 28	3	4	1 333
<i>Operation</i>			
August 29 1934			
<i>After Operation</i>			
September 18	22	6.5	295
September 26	8	6.5	812
October 5	10	4.5	450
October 14	10	4.5	450
October 25	11	8	727
November 7	13	5.5	423
November 21	15	8	533
December 3	12	6.5	541
December 11	9	5.5	611
December 21	10	5.75	575
January 2 1935	11	5.5	500
January 13	11	8	727
January 24	11	6	545
February 6	13	4.675	305
February 17	11	4.5	409
March 4	15	5.5	366
March 14	10	5	500
March 31	17	5	294
April 10	10	4	400
April 21	12	4.75	354
May 13	21	6.5	309
May 26	16	None	

peared following tapplings. After paracentesis the abdominal wall was loose and flabby, and no abdominal masses were to be felt. The liver could be palpated above and under the flared costal margins. His blood pressure was 106/74 millimeters mercury. The heart rate was 90 per minute. There was no enlargement of the heart to percussion. A small umbilical hernia was present.

Hemoglobin was 90 per cent, erythrocytes numbered 4,850,000, leucocytes, 9,600, coagulation time was 2 minutes. His daily urine output was about 800 cubic centimeters with a specific gravity of 1.025, acid reaction to litmus, amber in color, and contained no sugar, albumin, or cells. The ascitic fluid was a clear, straw amber color with a specific gravity of 1.015-1.017. It contained protein coagu-

lable by heat. His stools were well formed with one bowel movement daily. The Wassermann and Kahn tests were consistently negative.

The operation. Under ethylene oxygen plus ether anesthesia, a right rectus (10 centimeter) incision was made and about 3,000 cubic centimeters of ascitic fluid was aspirated. The parietal peritoneum was somewhat injected and slightly thickened. The liver was smaller than normal. Its surface was uniformly nodular, the nodules being about pea size (5 to 8 millimeters in diameter). The liver margins were rounded. It appeared dark grayish red in color. No biopsy of the liver was made. The omentum was shrunken.

Beginning 12 inches below the duodenojejunal junction 6 feet 8 inches of small intestine was removed. The ends were joined by lateral anastomosis. The abdominal wall was routinely closed with out drainage.

Postoperative course. The patient stood the operation surprisingly well and the postoperative care was as simple as possible. One liter of 5 per cent intravenous glucose solution was administered and ice water in small amounts was given by mouth beginning 6 hours after operation. A soft diet was given within 24 hours. Morphine and codeine were used as needed for pain. Small oil and 2 3 enemas with return flow were used to relieve gas and keep the large bowel open. In general the patient seemed to have but little more distress than does the usual appendectomy case. There was no postoperative rise of temperature. The wound healed by first intention. The patient was allowed up on the tenth day and walked out of the hospital on the fourteenth day.

Postoperative course. On the tenth postoperative day there was no detectable fluid on physical examination of his abdomen, and the ankles were free from edema for the first time in over 2 years. But by the fourteenth postoperative day the presence of abdominal ascites was discernible. The patient was tapped on the twenty second postoperative day and 6.5 liters of ascitic fluid was obtained. For the first 61 days from the day of operation an average of 0.491 liters per day of ascitic fluid were obtained in 5 tapplings; the average for 5 tapplings over a period of 62 days prior to operation was 0.951 liters per day.

In the next 59 days (5 tapplings) the average daily output was 0.546 liters per day; in the next 57 days (5 tapplings) 0.467 liters per day; in the next 64 days (5 tapplings) an average of 0.371 liters per day; 21 days later with an average of 0.309 liters per day (2 tapplings) 262 days following the operation ascites formation ceased and there has been no evidence of fluid in the abdomen to date.

From date of operation to present time the patient's general physical condition has constantly improved. He has gradually gained in weight and now weighs 15 pounds more than before operation.

Nor were all the benefits from the patient's viewpoint to be measured in actual per day accumulation

of fluid. For two and one half years before the operation he spent most of his time in wheel chairs and bed, leaving his bath robe and house slipper on him only for 2 or 3 days immediately following tapplings. From the time of the operation on, however, the patient has been active almost every day. The halved rate of ascitic accumulation for the first 6 months following operation allowed him to wear his business clothes comfortably and inconspicuously. During the 20 months of complete freedom from ascites his comfort and well being have further improved. From his former hopeless outlook he has become mentally well rehabilitated and his zest for living has returned.

This case has been under observation from July, 1932, until the present time, a period of over 5 years. During this time the patient received no relief from his ascites by medical treatment. There had been a gradual increase in the amount of ascitic fluid as well as a greater frequency of tapping until August 29, 1934, the date of operation.

A search of the literature has failed to reveal a previous case of enterectomy in the treatment of portal obstruction or cirrhosis of the liver.

After operation no dietary regimen was imposed, the patient being allowed to follow his appetite as to any type and amount of food and liquid desired. His urine output has averaged 1,300 cubic centimeters daily. Though the patient has not been constipated, he has had no tendency to diarrhea, sometimes noted following massive enterectomy.

CONCLUSION

We have presented one case of portal cirrhosis with ascites of more than 22 months' duration treated by tapping, with no tendency toward diminution. After massive intestinal resection the rate of ascites accumulation was immediately approximately halved, and following a period of gradual decrease of ascites its formation ceased 9 months after the operation. The patient has now been free from ascites for 29 months.

REFERENCES

1. BOLLMAN J. L. and MANN F. C. Experimentally produced lesions of the liver. *Ann Int Med* 1931 5 699.
2. DRUMMOND D. and MORISON R. A case of ascites due to cirrhosis of the liver cured by operation. *Brit M J* 1926 2 723.

- 3 FISCHLER, F. *Physiologie und Pathologie der Leber* Berlin J. Springer, 1916
- 4 HUGHSON, W. Portal cirrhosis with ascites and its surgical treatment, a review of 26 cases Arch Surg, 1927, 15 418-440
- 5 PATERSON, P. Lancet, 1910, October 29
- 6 RUOTTE Abouchement de la veine saphene externe aupéritione pour resorber les épanchements sciatiques Lyon med, 1907, 109 574
- 7 STRODE, J. L. Omentopexy in the treatment of cirrhosis of the liver Am J Surg, 1935, 28 135-141
- 8 TALMA, S. Chirurgische Oeffnung neuer Seitenbahnen für das Blut des Vena Porta Berl klin Wchnschr, 1893, 35 833

RELAXIN IN HUMAN SERUM AS A TEST OF PREGNANCY

DANIEL ABRAMSON, M D, F A C S, ELLIOTT HURWITT, A B, and
GERSON LESNICK, B S, Boston, Massachusetts

IN 1934 one of us (1) collaborated in a study of relaxation of the pelvic joints in pregnant humans, based on a large series of roentgenological and clinical material. Similar studies have been reported by Heyman and Lundquist, Barnes, Brooke, Roberts and Bristow, and Thoms. The conclusions, while differing slightly in detail are all in agreement on two essential findings: (1) that relaxation of the pelvic joints is a normal physiological occurrence during pregnancy, and (2) that this relaxation is demonstrable so early in pregnancy by x-ray that any mechanical etiology is rendered extremely unlikely.

In 1929 Hisaw and his co-workers were able to show that there was a substance elaborated by the corpus luteum of guinea pigs which caused relaxation of the pelvic ligaments. This hormone Hisaw named "relaxin." They were able to demonstrate it in the blood serum of several pregnant mammalia, including rabbits, guinea pigs, dogs, cats, sows, and mares. By injecting this substance into virgin guinea pigs in estrus, or in castrated pigs brought into artificial estrus with theelin, they were able to produce marked and easily demonstrable relaxation of the symphysis. However, they showed that neither theelin alone, nor relaxin without the preliminary "sensitizing" of the animal with theelin, had any such effect. They thus described a synergistic one-two action between theelin and relaxin. The latter substance has been isolated in relatively pure form.

From the Department of Obstetrics Harvard Medical School Boston Lying In Hospital and Research Laboratory of the Beth Israel Hospital

This one-two relation between theelin and relaxin was shown remarkably clearly by Hisaw in the male guinea pig. The pubic bones of the male are united by cartilage rather than by ligaments as in the mature female. By injecting castrated males with theelin he was able to convert the pubic joint to the ligamentous type, which then responded to relaxin.

This effect caused by theelin with the multiplication of connective tissue elements, is probably responsible for the slight amount of periodic estrus relaxation noted in virgin guinea pigs by Brouha and Simmonet, and by Pommerenke (25). The same observation has been made in menstruating humans by Goldthwait and Osgood, and by Chamberlain. The results of deFremercy, Kober, and Tausk, and more recently of Tapfer and Haslhofer in producing some relaxation by massive injections of one or another preparation of the female sex hormone are also probably on this basis. We also have observed this, but the slight degree of separation achieved can be greatly increased by an additional small dose of relaxin, and should not be construed as evidence against the existence of relaxin.

Hisaw investigated the blood of pregnant women during the last trimester of pregnancy, and failed to find the hormone. He was forced to conclude either that the mechanism was different in humans or that demonstrable amounts of relaxin were present only early in pregnancy. The early widening shown by the x-ray makes this latter possibility extremely likely. Moreover the various observations indicating the lack of function of the corpus

alone rather than to a new corpus luteum hormone, relaxin. As further evidence they state that serum from rabbits late in pregnancy, when the corpus luteum had regressed, was much more effective in producing relaxation in experimentally prepared guinea pigs than early pregnant rabbit serum. In this regard it is interesting that, on x ray study of pregnancy humans, both Barnes and Thoms, find that relaxation first appears in the middle of the second trimester and that from there on to term it is a progressive affair. However the measurements reported by Brooke Roberts and Bristow and by Abramson Wilson and Roberts, show that widening develops as early in pregnancy as the eighteenth to twentieth week. These workers also confirm the conclusion of Heyman and Lundquist that there is little increase in relaxation during the last trimester or in labor, the maximum rate of increase being from fifth to seventh month. This early relaxation taking place during the phase of corpus luteum activity with lack of increase during the last trimester when the corpus luteum has regressed, point to this organ as the source of the substance responsible for the joint and ligamentous changes. On three occasions pigs with this slight preliminary theelin relaxation were injected with pregnant rabbit or human serum and in each instance the degree of relaxation was strikingly increased. The hypothesized one two relation between theelin and relaxin is thus emphasized.

The subjective factor in palpating these pigs has been ruled out as much as possible by having someone else feel the pigs. Not knowing which pigs had been injected he would be given a group of animals containing some controls. In no instance was there any hesitancy about picking out the pigs that had relaxed, although at times among the controls were pigs showing the slight theelin relaxation. It is realized that could an objective measurement or demonstration of this relaxation be obtained the results would be far more convincing. However, the palpable increase in mobility which has gone by the end of 30 hours, is thought to represent a ligamentous relaxation rather than an actual separation of joint surfaces as shown by x ray in humans.

There are both advantages and disadvantages of the use of this procedure as a test for pregnancy. Its main advantage is that the test will produce results in a period of only 12 hours. Its disadvantages, unfortunately, make the procedure rather an impractical one. The pigs must be ovariectomized, they cannot be used until brought into artificial estrus with theelin, which requires 4 to 5 days, blood serum must be used and preferably that in the first half of pregnancy. This is made difficult by the fact that patients in the obstetrical clinic usually do not present themselves for first examination until they have approached the end of the second trimester or beginning of the third trimester. Even then it is much more difficult and more bother to obtain blood from patients than it is urine. The concentration procedure requires approximately 3 hours, and the divided injections of the prepared substance an additional 1½ hours. Occasionally the pigs have unpredictable reactions from the serum. It is best in order to obtain accurate results that a pig be used for only one test. The reason for this is the extreme toughness of the skin everywhere except over the abdomen and this region becomes considerably fibrotic after one course of theelin plus pregnant serum concentrate. As a routine test of pregnancy, therefore, this is both expensive and impractical.

SUMMARY

- 1 A substance was demonstrated in the corpora lutea of sows and the serum of pregnant rabbits which was capable of producing symphyseal relaxation in guinea pigs in normal or artificial estrus.

- 2 This substance was first described by Hisaw and named relaxin.

- 3 Although slight to moderate degrees of relaxation can be produced in guinea pigs by large doses of theelin, the separation is greatly increased by a small additional dose of relaxin.

- 4 Pelvic relaxation in pregnant animals is therefore not solely a theelin effect. The synergistic one two relation between theelin and relaxin is emphasized.

- 5 A procedure has been developed for concentrating human blood serum taken from

women in the first half of pregnancy which has acted on guinea pigs in a manner similar to that of relaxin

6 Symphyseal relaxation in guinea pigs in artificial estrus was produced by the sera of 15 consecutive women in the first half of pregnancy. The serum of 1 woman in the eighth month of pregnancy and that of 2 non-pregnant women, and of 1 male were ineffective

7 It is believed that pelvic relaxation during pregnancy is facilitated by, or at least in part is due to the hormone relaxin and in the human species as well as in many other mammalia

8 As a routine test of pregnancy this procedure is deemed impractical

We wish gratefully to acknowledge the helpful interest of Drs Hisaw and Fevold

BIBLIOGRAPHY

- 1 ABRAMSON, D, ROBERTS, S M, and WILSON, P Surg, Gynec & Obst, 1934, 58 595-613
- 2 BARLOW Monthly J M Sc, Edinburgh, 1854, p 83
- 3 BARNES, J M Roentgenol, 1934, 32 333-352
- 4 BELL The Sex Complex, London, 1920
- 5 BREHM, W, and WEITRAUK, H Am J Obst & Gynec, 1928, 15 187-191

- 6 BROOLE, ROBERTS, and BRISTOW Proc Roy Soc Med, 1934, 27 1211-1230
- 7 BROUHA and SIMMONET Compt rend Soc de Biol, 1928, 99 1769
- 8 CANTIN, L Thesis, Par, 1899
- 9 CERNE Normandie m  d, Rouen, 1895, 10 399-402
- 10 CHAMBERLAIN, W E Am J Roentgenol, 1930, 24 621-635
- 11 DEFREMERY, KOBER, and TAUSK Acta Brevia Neerlandica, 1931, 1 146
- 12 DRIVER, S W Boston M & S J, 1887, 117 245-250
- 13 ESSEN MOELLER, E Zentralbl f Gynaek, 1904, 28 869
- 14 FRAENKEL, L Arch f Gynaek, 1903, 68 438
- 15 GOLDTHWAIT, J E, and OSGOOD, R B Boston M & S J, 1905, 152 593-601
- 16 HERRICK, E Anat Rec, 1928, 39 193
- 17 HEYMAN, J, and LUNDQUIST, A Acta Obst & Gynec Scand, inav 1932, 12 191-226
- 18 HISAW, F L J Exper Zool, 1935, 42 411
- 19 Idem Physiol Zool, 1929, 2 59-79
- 20 Idem J Am Chem Soc, 1932, 54 254-64
- 21 KNOX Lancet, 1839, 1840, Med Gaz, 1843
- 22 LOESCHKE, H Arch Gynaek, 1912, 96 525-560
- 23 MARTIUS, H Arch f Gynaek, 1929 1930, 139 581-613
- 24 MULLER, W Zentralbl f Gynaek, 1931, 55 999-1006
- 25 POMMERENKE, W T Anat Rec, 1933 27 361-367
- 26 Idem Am J Obst & Gynec, 1934, 27 708-713
- 27 PUTSCHER, W Verhandl der deutsch path Gesellschaft 1930 25 214-219
- 28 REIS BAER, ARENS, and STEWART Surg, Gynec & Obst, 1932, 55 336-354
- 29 SNELLING, F G Am J Obst, 1870, 2 561
- 30 TAPPER, S, and HASLHOFER, L Arch f Gynaek, 1935, 159 313-331
- 31 THOMS, H J Am M Ass, 1936, 106 1364-1366

EPIDERMOID CARCINOMA IN CYSTIC TERATOMA OF THE OVARY

H E BOWLES, M D, Honolulu, Hawaii

IN 1925, Gordon ably pointed out the need for a universally acceptable terminology in referring to the various cystic and solid growths arising from the ovary. The names teratoma, embryoma, dermoid cyst, teratoid, mixed cell tumor, and others are used often as synonyms in articles written in the English language. The European writings add still more variety to this list. It would seem entirely logical to adhere to Gordon's suggestion that we follow the terms used by Ewing, Frank, Frankl, and others who refer to ovarian teratomas as being of two types: the cystic or common ovarian dermoid, and the solid teratoma. Graves, on the other hand, does not use the word teratoma when referring to a dermoid cyst. We shall use the terms cystic ovarian teratoma as synonymous with dermoid cyst of the ovary, and solid teratoma as referring to the rarer and essentially malignant solid teratoma of the ovary. The solid and cystic teratomas resemble each other in that they may both contain tissues representative of entoderm, ectoderm, or mesoderm.

In discussing cystic teratoma of the ovary, we must distinguish it from other dermoid tumors which are congenital sequestration tumors found at the lines of embryonic fusion, and which arise by the development and inclusion of cells of ectodermal origin.

A cystic ovarian teratoma, or dermoid cyst of the ovary, is well described by Adams, and Boyd. This is a cyst occupying the situation of an ovary with a lining of cubical or squamous epithelium. It is invariably provided by a nipple like mass or process called by Roktansky "the insular protuberance," a structure which is regarded as representative of the head. This is the essential part of the tumor and gives rise to the various solid elements which are to be found in the cystic teratoma. The tuft of long hair commonly

seen arises from this small lump and one or more teeth are often seen embedded in pieces of bone which at times have an appearance suggestive of a jaw. There is invariably a certain amount of semi-oleaginous material of yellowish tinge which solidifies on cooling. It is produced by small sebaceous and sudorific glands which are present here as they are in normal epidermis in its proper anatomical location. If one constantly bears in mind that an ovarian cystic teratoma is totipotent, that is, it may contain ectoderm, entoderm, and mesoderm, then it can be understood that thyroid tissue, mammary glandular elements, portions representing a testicle, in short almost any bizarre arrangement may conceivably occur in such a tumor. Kovacs reports a case of hyperthyroidism in a patient whose symptoms promptly disappeared following the removal of an ovarian dermoid containing thyroid tissue. Pick has mentioned "hydatidiform mole like" structures in a case of dermoid cyst.

The origin of cystic teratoma has been the subject of much academic discussion, and it is generally conceded that neither the blastomere theory of Marchand and Bonnet (10), nor the germ cell theory of Wilms can account for every case of this type of tumor. It may well be a combination of the two ideas and there may still be other possibilities that have been overlooked as to the histogenesis of ovarian dermoids. Boesius has attempted to prove their origin by making heteroplastic and autoplasmic transplants of amphibian embryos into different parts of the bodies of adult amphibians. The embryonic tissues developed, unprotected by membranes, obtained their blood supply from their hosts, and went on to develop into polycystic tumors resembling cystic teratomas in structure and composition. Stout feels that this work lends support to the theory that these tumors are really an expression of parthenogenesis.

From the Clinic (Honolulu)

Ewing scouts the blastomere or polar-body theory remarking that it cannot account for the occurrence of as many as seven dermoids in one ovary and eleven in both organs. As a matter of fact Novak has reported ten dermoids in one ovary, and eleven in the other.

It is possible for retroperitoneal teratomas as well, to develop from isolated blastomeres or germ cells of an accessory retroperitoneal ovary. Gordon cites one such cystic ovarian teratoma which included the right kidney within its capsule. Kolb in 1909 stated that no solid retroperitoneal ovarian teratomas had yet been reported. Recent literature still fails to show accounts of any such tumors.

Dermoid cysts of the ovary do not seem to show any particular predilection for one side more than the other. They are usually unilateral, but are not infrequently bilateral. Graves states that 5 to 10 per cent of all ovarian tumors are dermoid cysts. The incidence of bilaterality is given by Boyd and by Deaver as 10 per cent of all dermoid cysts of the ovary. Gordon gives the range as "from 2 to 14 per cent", Koucky says 13 per cent, Meigs found 8.3 per cent of 60 to be bilateral, while Campbell concludes that bilateral cystic teratomas of the ovary are rare and are to be found in only 1 per cent of cases.

These tumors may occur from early infancy to old age. According to Polak they are the commonest ovarian tumors prior to puberty. Lever reports the occurrence of a large dermoid cyst of the ovary in an infant of 7 weeks, while Rossie reports a similar one in a 10 month old baby. With such data, it is not too much of a stretch of imagination to consider that an ovarian teratoma could develop within the fetus prior to its birth, and that it probably did so in Lever's case. Eggenberger reported one the size of a baby's head in an 8 year old child, and Pühr has recently written an account of a 9 year old girl who was operated on for an ovarian dermoid the size of a small child's head. The tumor in the latter case had undergone malignant change and showed adenocarcinoma as well as basal cell epithelioma.

An ovarian dermoid is considered large when it reaches the size of a grapefruit. Most of them range in size from that of a hen's egg

to that of an orange. Galabin reports the occurrence of an astonishingly large cystic teratoma of the ovary which weighed 160 pounds.

Among the numerous complications which may arise from the presence of these dermoid cysts should be mentioned some which need not be associated with neoplastic changes within the tumor. Torsion of the mass on its pedicle, which is apt to be long, may give rise to symptoms of toxemia due to the absorption of necrotic material. Numerous adhesions may form and result in a picture suggesting acute, subacute, or chronic ileus. Tuberculous peritonitis may be so closely simulated as to be clinically indistinguishable from it.

About a year ago the author saw a young Japanese woman in consultation in whom the symptoms, history, physical findings, intermittent septic type of fever, and high white cell count together with an acutely tender fluctuating mass in the cul-de-sac of Douglas led to the diagnosis of a cul-de-sac abscess. Posterior colpotomy yielded, first, thick, malodorous pus which was followed by a stream of oily fluid mingled with hairs. Three weeks later, a densely adherent typical ovarian dermoid cyst was removed at laparotomy. The dermoid may rupture into the sigmoid, rectum, or bladder. In the past, the passage of hairs in the urine has led to the diagnosis. Mayer's case was diagnosed on the finding of hairs in the stools.

Inasmuch as tissues originating from ectoderm, entoderm, or mesoderm may occur in ovarian dermoids, various types of malignancy have been found. Dougal has reported primary chorioepithelioma originating within the tumor. Amann and Lorrain have found pigmented sarcomas. Yamagiwa has reported the occurrence in the cystic ovarian teratoma of an adenocarcinoma such as is found in the breast. Litten has found a round cell sarcoma in the wall of an ovarian dermoid, with metastases to the liver. The occurrence of malignancy in dermoids of the ovary runs parallel with the incidence of malignant tumors elsewhere. Koucky believes that 1 per cent of cystic ovarian teratomas undergo malignant alterations. Goodall and Deaver say 3 per cent, while Gordon places the figure

TABLE 1—SUMMARY OF RECENT CASES OF EPIDERMOID CANCER RECURRING IN CYSTIC OVARIAN TERATOMAS

Case No.	Author year	Age yrs	Pregnancies	Duration		Pre-operative diagnosis	Treatment	Outcome
				Tumor	Pain			
44	Millot and Howard 1934	46	4	?	4 mos	(1) Incomplete abortion (2) Myoma uteri	Left salpingo-oophorectomy	Not stated
45	Caillot and Boulez 1934	48	0	?	2 mos	Uterine tumor	Bilateral salpingo-oophorectomy	Re-operation in 2 wks. Enterostomy for a uterine death in 6 weeks
46	Caillot and Boulez 1934	19	0	4 mos	2 mos	Uterine sarcoma	Left salpingo-oophorectomy. Subtotal hysterectomy	Fatal termination expected soon
47	Denis 1935	34	?	?	2 mos	Intestinal obstruction	2 stage operation (1) closure of cecal perforation and colo tomy (2) left salpingo-oophorectomy and intestinal resection	Not stated. Considered hopeless as pelvis filled with recurrent mass
48	Denis 1935	68	3	6 to 13 yrs	21 yrs moderate to severe	Ovarian tumor	Left salpingo-oophorectomy. Resection of intestine	Immediate recovery. Pregnancy had. Follow up not stated
49	Bowles 1936	68	2	20 yrs	None	Left ovarian cyst (fibroid uterus) (7)	Bilateral salpingo-oophorectomy	Died 4 months after operation

at 3 to 5 per cent. Graves remarks that there is only a slight tendency of the ovarian dermoid to become malignant, as compared with the solid teratoma. Other authors including Crossen (20), Anspach and Cameron remark that these tumors are potentially malignant, and some of them undergo malignant changes.

It is well to be cautious before making a flat statement that a given malignant tumor has originated within the ovary. Masson and Ochsenhuth have pointed out that there are three possibilities: (1) the malignancy may develop within the dermoid, (2) malignancy may form in a portion of an ovary or a malignant ovarian cyst associated with a dermoid in another part of the same ovary, and (3) malignant invasion of the dermoid may occur from an adjacent organ.

We have considerable evidence that malignant tumors arising in cystic ovarian teratomas can and do metastasize as do malignant tumors occurring elsewhere. The metastases may be teratoid, carcinomatous, or a simple tissue as glia only. Clark states that distant metastases as to the axillary glands are uncommon. Kleinknecht and colleagues report the case of a cystic ovarian teratoma in a young woman in whom an acute abdominal crisis was precipitated by extensive hepatic and retroperi-

toneal tumor masses which were apparently secondary to the ovarian tumor. Unfortunately, histological confirmation is lacking. Puhr's patient, a 9 year old girl with basal cell epithelioma and adenocarcinoma occurring in an ovarian dermoid, died shortly after laparotomy with the diagnosis of brain tumor. Autopsy showed extensive metastases to the spine, cranium, and other bones. It was believed that they originated in the ovarian dermoid but again histological evidence is lacking. Krukenberg, Ascanio Suarez, and Counsellor have reported cases of ovarian dermoids containing squamous cell cancer which had metastasized to the liver.

Most cases of malignancy occurring in ovarian dermoids are epidermoid carcinomas of the squamous type. In 408 such cysts at the Mayo Clinic between 1912 and 1931, 7 or 1.7 per cent, were proved grossly and microscopically to be associated with primary epithelioma of the epithelial elements of the cysts. Frank states that the carcinoma takes the form of ripe squamous epithelioma with pearl formation. Even though the pearly bodies are usually present, it is not invariably so as can be seen by examining the reports of Masson and Ochsenhuth, who have shown some of the epidermoid carcinomas to contain

more youthful squamous cells without pearl formation. Gordon gives the percentage of epidermoid carcinoma in malignant tumors originating in cystic teratomas of the ovary as from 3 to 5. Out of 60 dermoids of the ovary, Wiener found 3 specimens, 5 per cent, to show epidermoid carcinoma. Surely a careful examination of all ovarian dermoids removed at operation would show many more instances of malignancy than are being reported.

Meigs issues a warning note pointing out that simple dermoid cysts of the ovary may show epithelium which looks like carcinoma but is not. He considers that the presence of malignant areas in a dermoid does not necessarily mean a bad prognosis as much depends on whether the growth has perforated the capsule and invaded the peritoneum.

The age incidence of epidermoid carcinoma in cystic ovarian teratoma parallels that of this type of cancer in other portions of the body. It seems reasonable to expect that the younger the patient, the more rapidly fatal the outcome. The three youngest authentic cases of squamous cell cancer in ovarian dermoids to be reported in the literature are those of Caillot, Reppun, and Bierman. The patients' ages were 19, 20, and 21 years, respectively. Bierman's patient was not operated on but died on the third day after examination, and necropsy revealed extensive invasion of the bladder, rectum, uterus, and left ovary (the primary tumor was in the right ovary). Squamous carcinoma cells with epithelial pearls were found in profusion. Reppun's patient died 3 days after operation. The rectum and sigmoid were extensively involved. Caillot's patient was still living a few months after operation but the prognosis was regarded as hopeless as an absolute extirpation was impossible due to infiltration of neighboring viscera.

In the series of cases of epidermoid cancer in cystic ovarian teratomas reported by Masson and Ochsenhirt, the results were recorded in 18. Death followed from recurrence in from a few days to 2 years after operation in the majority. Lapouge's patient lived 7 years and died of abdominal recurrence. Ludwig's patient was well at the end of 2 years but

further report is lacking. Masson and Ochsenhirt have reported 1 of their cases to be well at the end of 5 years. Counsellor's patient was reported to be in good health 15 years after operation.

In addition to the squamous cell types of cancer found in dermoids of the ovary, typical basal cell cancers have been reported by Spaulding and Puhr. Puhr's case was also associated with adenocarcinoma.

To date there has been no satisfactory method of early diagnosis of malignancy occurring in a dermoid. We should strive, however, to attain greater accuracy in the diagnosis of pelvic tumors. Numerous articles have appeared attesting to the value of roentgenographs in the diagnosis of ovarian dermoids. Among these should be mentioned papers by Aime, Eideken, and Spillman. In interpreting the films it should be borne in mind that a single tooth lying in the line of the ureter may be confounded with a ureteral calculus. Spillman and Knox, have remarked on such a possibility, and Sonntag cites a case in which a tooth was mistaken for a stone in the ureter. Alexander refers to a similar case in which a second picture taken from the side threw out the tentative diagnosis of ureteral stone. In our case, the report of which follows, we failed to have made roentgenograms of the pelvis, and hence the dermoid cysts were not diagnosed until operation.

In addition to the dangers of metastasis in these tumors, we have to deal with those associated with the infiltration of adjacent organs by the tumor mass. Acute intestinal blocking may precipitate an emergency as did Denis' case, a patient aged 34 years. Forster's patient showed extensive invasion of the ileum with pearl formation in the cyst as well as in the intestinal wall. Fairbairns' patient had extensive bladder involvement, and Millot and Denis, have reported severe uterine bleeding in their patients.

The ideal treatment of all ovarian dermoids, whether they appear benign or malignant, is still total and clean ablation whenever possible and as soon as possible as urged by Senn in 1895. One should never temporize longer than is absolutely necessary if the patient is

in any condition to permit operation. When complete removal is impossible, one must attempt to relieve intestinal obstruction by whatever procedure seems to promise the most relief in that particular case. Colostomy may sometimes be necessary. In extensive bladder invasion, it may be imperative to give temporary relief by transplanting the ureters into the lower large bowel, or if that is impossible to the abdominal walls to permit external drainage of the urine. Hysterectomy is often necessary.

Many of the patients who have had dermoid cysts of the ovaries have had several normal pregnancies. Our patient aged 68 years when she consulted us for the first time, had had two uneventful pregnancies and deliveries in spite of bilateral cystic ovarian teratomas. Perusal of the literature yields the record of only one other case resembling ours in that both ovaries had been replaced by cystic teratomas, only one of which had become the site of squamous cell carcinoma. This was reported by Krukenberg in a woman 43 years of age. No references have been found of bilateral ovarian dermoids both of which have become malignant.

Counciller in 1934, reported the fortieth to the forty third cases of cystic ovarian dermoid to undergo intrinsic changes due to squamous cell carcinoma. Since then 5 other authentic cases have been added. These have been reported by Millot, Caillet (2 cases), Demis and Duffant. Ours therefore, makes the forty ninth. A resume follows.

Mrs. I. I. Japanese aged 68 years, was admitted to Queen's Hospital September 13, 1936 complaining of constipation, low sacral backache and a large lump in the lower left abdomen.

About 20 years ago she first noticed a lump in the lower left abdomen. It was about the size of a baseball at that time. It has slowly enlarged until last year since when the enlargement has been more rapid. There has never been any pain in the region of the lump nor anything but a feeling of heaviness. The appetite has always been good, but during the past year constipation and low sacral backache have developed insidiously and have slowly increased. The sluggishness of her bowels is the most distressing symptom.

She has never been ill nor has she been to a doctor until now. The menses have been regular until menopause 10 years ago. She has never suffered from dysmenorrhea. The family history is irrelevant.

She smokes cigarettes heavily but uses no alcohol.

Physical examination revealed a shrunken Japanese woman of about 70 years. She did not appear critically ill or in any way suffering. Her temperature was 98.2, pulse 76, respiration 18. The only positive physical findings were (1) bilateral circulus senilis, (2) sluggishness of direct and consensual pupillary reflexes, (3) moderate deafness both ears, (4) a few teeth missing, (5) slight gingivitis, (6) heaving pulsation both sides of neck, (7) a few firm enlarged lymph nodes both sides of neck, freely movable, (8) lungs moderately hyperresonant throughout, (9) abdomen enlarged to size of 5 months pregnancy, most of the mass to the left of the midline where a large hard rounded tumor could be felt. It seemed to be attached firmly on its under surface to the subjacent structures. It felt smooth and rounded but no fluctuation could be elicited. It was not tender on firm pressure but the patient winced when the tumor was pushed very far to either side. The anterior part could be moved but the base seemed fixed. Other abdominal findings were negative. (10) The uterine body was not distinct and seemed to merge with the tumor mass. There was a firm rounded fullness of right adnexal region but no tenderness. The entire left iliac fossa was filled with the large tumor. No tenderness was noted in the left flanks. (11) The extremities were poorly muscled.

The blood Wassermann and Kahn tests were negative. All other tests were within normal limits for a woman of 68.

The pre-operative diagnosis was left ovarian cyst or large myomatous uterus possible left renal tumor.

Operation was done under neocain intra-pinal anesthesia. No additional anesthetic was necessary. On incision of the peritoneum a small amount of free straw-colored fluid was seen and was removed by vacuum suction. An elliptical tumor the size of a full term fetal head was now encountered the presenting surface of which was smooth and a beautiful lemon yellow in color suggesting a layer of thick cake frosting. This tumor lay in the hollow of the left ileum and was densely adherent to the fascia on the under side of the tumor. It displaced the descending colon and the sigmoid nearly to the midline of the abdomen and was densely adherent to their lateral surfaces. Although there were obvious patches of thickening and induration in the tumor these were all smooth and no irregular papillomatous or fungating areas were found on its outer surface. The tumor felt like a cyst under marked tension. The lower pole connected with a wide band of tough tissue which formed a pedicle representing the left adnexal attachments to the uterus. The tumor mass was freed first on its under surface working medial from its lateral boundaries. Having freed it from its bed we were now able to flip the tumor over in a counterclockwise direction to the midline of the abdomen. The adnexal pedicle was severed and ligated, and the mesial side of the tumor, adherent

to the sigmoid and descending colon was freed by careful blunt dissection. This allowed the tumor to be removed. A raw bed remained. It did not bleed, and was left alone as no tissue was available with which to cover it. The extirpated left ovarian tumor measured 19 by 16 by 14 centimeters. Later, it was found that its walls were 1 millimeter in thickness at the thinnest portions and 2 centimeters at the thickest. It was also found to contain several large loculations filled with semi solid lard like material and many long black hairs. Rokitsky's insular protuberance was clearly demonstrable in the largest loculation. It was roentgenographed after removal and two small plaques of bone were clearly visible.

Another adherent cystic tumor arising from the right ovary was next removed from the right iliac fossa. Despite precautions, this ruptured during its extirpation. It was found to contain oily fluid, hairs, teeth, and bone. The entire sac was removed and the raw surface partly peritonealized. The abdomen was closed without drainage. Crossen, Ashton, Bovee, Doyen and others warn against the dangers of spilling the fluid from these dermoid cysts. It is said to be very irritating and may produce a serious peritonitis. The literature is strangely silent as to exactly why this fluid should be so irritating in the absence of infectious organisms. Our cultures taken from this spilled fluid were negative. Senn has remarked that aside from the irritation alone and the resulting adhesions, the spilled contents may produce large numbers of secondary growths the most of which are the size of a cherry. These are each furnished with a tuft of lanugo like hair, and occur in clusters or imbedded in adhesions.

The first 4 days were stormy but the patient left the hospital on the sixteenth postoperative day in good general condition with a firm scar.

Three months after operation, she was up and about having no complaints except occasional low sacral backache which was relieved by small doses



Fig 1 Gross appearance of carcinomatous dermoid cyst of left ovary

of codeine and aspirin. Bowel action had improved and she required only occasional mild laxatives.

Since the capsule of the large left ovarian cystic teratoma was definitely broken through on its under surface making the total ablation of the subjacent tissues impossible, the patient was not expected to survive for long. She died in the country 4 months and 4 days after the operation. Unfortunately, we were informed too late to obtain an autopsy. Her sons stated that she had had no further trouble from constipation though her backache persisted until death, which was a gradual one. The patient weakened from day to day for the last 2 weeks of her life.

Histological sections were prepared from pieces of tissue excised from the notched area appearing just above the ends of the short ruler in the photograph, and also from the under surface which does not show. The picture shows the undulations pro-



Fig 2 Low power magnification of section near wall



Fig 3 High power magnification of section near wall. Note mitotic figures.

duced by carcinomatous patches in the tumor wall Hair and caked fatty material can also be clearly seen

SUMMARY AND CONCLUSIONS

It is suggested that we adhere to the terminology of Ewing, Frank, and others in discussing ovarian teratomas, dividing the group into solid and cystic teratomas. The latter is used synonymously with the term dermoid cyst of the ovary.

Either type of teratoma may contain tissues representing ectoderm, endoderm, or mesoderm. Hence many bizarre arrangements occur.

The essential part of an ovarian dermoid is the 'insular protuberance' whence the solid elements of the tumor arise.

Opinion is still divided between the blastomeric and the germ cell theory of origin of cystic teratoma of the ovary.

Five to 10 per cent of ovarian tumors are said to be dermoid cysts. Various authors state that bilateral ovarian dermoids occur in from 1 to 14 per cent of cases. Cystic teratoma of the ovary has been reported as occurring between early infancy and old age. It is the commonest ovarian tumor that is found prior to puberty.

Numerous complications may result from ovarian dermoids among which are intestinal obstruction of varying degrees, toxic symptoms due to torsion of the tumor on its pedicle, infection and peritonitis, uterine hemorrhage and malignant degeneration of the tumor.

The incidence of malignancy in cystic teratomas of the ovary runs parallel with malignancy elsewhere in the body. Figures of various authors vary, thus anywhere from 1 to 5 per cent of all ovarian dermoids have been shown to be malignant. They are all potentially malignant.

Caution must be used in making a definite statement that a given malignant tumor has originated within the ovary. It may have arisen in another part of the ovary and extended into the dermoid cyst or the invasion may have occurred from primary malignancy in an adjacent organ.

Most malignant tumors occurring in ova-

rian dermoids may metastasize. The liver is frequently involved.

Of all the possible types of malignancy that may occur in an ovarian dermoid, squamous cell carcinoma is the commonest (3 to 5 per cent). The prognosis is gloomy in most cases if the capsule has been broken through and peritoneal invasion has occurred.

Roentgenographs of all ovarian tumors would add to the accuracy of the preoperative diagnosis.

The only satisfactory treatment of ovarian dermoids is early and complete removal of the tumors. Any patient who is a good risk should receive operation.

Since Counseller's report in 1931, 5 additional cases of epidermoid carcinoma originating in ovarian dermoid cysts have been reported, bringing the total of authentic cases up to 48. The author wishes to add 1 more case to the list, bringing the total to 49. Death occurred in 4 months after operation, in this last case.

REFERENCES

1. ADAMI, J. G. Principles of Pathology. Vol. 1, p. 65, Philadelphia and New York, Lea & Febiger, 1910.
2. AIME, P. Le diagnostic radiologique des kystes dermoïdes de l'ovaire. J. de rad. ol. et électrol. 1925, 9, 230.
3. ALEXANDER. Die Vortauschung eines Uretersteins durch den Zahn eines Ovarialdermoïds. Ztschr. f. urol. Chir. 1923, 14, 163.
4. AMANN. (Report concerning melanotic sarcoma in an ovarian dermoid.) Monatschr. f. Geburtsh. u. Gynaek. 1903, Jan.
5. ANSPACH, B. M. Gynecology, p. 397. Philadelphia and London, J. B. Lippincott Co., 1927.
6. ASCANIO SUAREZ, R. Malignant degeneration of dermoid cyst case. Rev. de med. y ciruj. de la Habana, 1929, 34, 624.
7. ASHLEY, W. E. A Text book on the Practice of Gynecology, 2d ed., p. 523. Philadelphia and London, W. B. Saunders Co., 1906.
8. BIERMAN. Zur Kenntnis der secundären Geschwulstentwicklung in Teratomen des Ovariums. Fragm. med. Wchnschr., 10, 201.
9. BOESTIUS. Beiträge zur Kenntnis der Genese der Ovarialembryome. Upsala, Almqvist & Wiksells, 1926.
10. BONNET, R. Ergebnisse der Anatomie und Entwicklungsgeschichte, 1890, p. 820.
11. BOVEE, J. W. The Practice of Gynecology, p. 569. Philadelphia and New York, Lea Bros. & Co., 1906.
12. BOYER, F. Zur Casuistik der Dermoidcysten und ihren Metastasen. Arch. f. Gynaek. 1910, 92, 350.
13. BOYD, W. Surgical Pathology, 3d ed., p. 515. Philadelphia, W. B. Saunders Co., 1933.
14. CAILLOT, J. and BOULEZ, N. Two cases of epitheliomatous degeneration of dermoid cysts of the

- ovary Bull Soc d obst et de gynec, 1934, 23 546
1. CAMERON, J L Post Graduate Surgery Vol 2, p 2041 New York Appleton Century, 1936
 - 16 CAMPBELL Clin J 1917, 47 286
 - 17 CLARK, J G Am J Obst, 1898, 38 3
 - 18 COUNSELLER, V S, and WELLBROCK, W I A Squamous cell epitheliomas in dermoid cysts of the ovary Am J Obst & Gynec, 1934 28 40
 - 19 CROSSEN, H S Operative Gynecology p 370 St Louis The C V Mosby Co, 1917
 - 20 CROSSEN, H S, and CROSFEN, R J Diseases of Women 8th ed, p 770 St Louis The C V Mosby Co, 1917
 - 21 DEEVER, J B Carcinoma in dermoid cyst Surg Clin N America 1931 11 1267
 - 22 DENIS, J B, DENIS, R, and DUPLANT, Fr Etude de deux cas de dégénérescence cancéreuse de kystes dermoïdes de l'ovaire Lyon med, 1935, 155 93
 - 23 DOUGAL, D Primary chorioepithelioma of ovary J Obst & Gynec Brit Imp, 1924, 31 387
 - 24 DOYEN, E Surgical Therapeutics and Operative Technique Vol 3 p 743 New York William Wood & Co, 1917
 - 25 EGGENBERGER Report of a dermoid cyst in an eight year old child Baseler med Gesellsch, 1908, Feb
 - 26 EIDELER, L Unsuspected dermoid cyst diagnosed by roentgen examination Am J Roentgenol, 1922, 9 15
 - 27 EWING, J Neoplastic Diseases 3d ed, p 662 Philadelphia W B Saunders Co, 1928
 - 28 FAIRBAIRNS J S Dermoid cyst of right ovary, epithelioma in wall involving bladder, omentum, etc St Thomas Hosp Rep, 1899 28 270
 - 29 FORSTER, D S Case of malignancy in dermoid cyst of ovary Canadian M Ass J, 1927, 17 322
 - 30 FRANK, W F Gynecological and Obstetrical Pathology, Gynecological and Obstetrical Monographs p 417 New York and London D Appleton & Co, 1922
 - 31 FRANKL, O Karzinomatoeses Ovarialdermoid Centrabl f Gynaek, 1920, 44 373
 - 32 GALABIN Cited by Bovee, loc cit
 - 33 GOODALL, J R Nelson Loose Leaf Living Surgery Vol 7, p 293 New York Nelson & Sons, 1937
 - 34 GORDON, O A Teratomata—ovarian and retroperitoneal Surg, Gynec & Obst 1925, 41 399
 - 35 GRAVES W P Gynecology 3d ed, p 428 Philadelphia W B Saunders Co, 1923
 - 36 KELLY H A Gynecology p 750 New York and London D Appleton & Co 1928
 - 37 KLEINANECHT, A, PERROT, A, and GINGLINGER, A Kyste dermoïde de l'ovaire, dégénérescence maligne, généralisation des métastases hépatiques Bull de la Soc d'obst et de gynec de Par, 1932, 21 365
 - 38 LAYOY R Radiography and Radiotherapeutics Part 1—Radiography, p 380 and plate 76 New York The Macmillan Co, 1917
 - 39 KOLB, K Das Retroperitoneal Teratom Heidelberg, 1909
 - 40 KOUCKY, J D Ovarian dermoids study of 100 consecutive cases Ann Surg, 1925 81 321
 - 41 KOVACS, I Thyroid tissue tumor in ovary Arch f Gynaek, 1924 122 766
 - 42 KRUKENBERG, G Ueber das gleichzeitige Vorkommen von Carcinom und Dermoidcyste in ein und demselben Ovarium Arch f Gynaek, 1887 30 241
 - 43 LAROUZE, C V de D genérescence maligne des kystes dermoïdes de l'ovaire Arch gén de chir, 1914, 8 769
 - 44 LEXER, E Arch f Klin Chir, 41 62
 - 45 LITTEN Arch f path Anat 1879 75 329
 - 46 LORRAIN Bull Soc Anat de Par, 1925 80 421
 - 47 LUDWIG, H Ueber primäre maligne Degeneration der zystischen embryoiden Geschwulste der Ovarien Wien klin Wchnschr 1905 18 715
 - 48 MACCALLUM W G A Text book of Pathology 3d ed, p 1087 Philadelphia W B Saunders Co, 1924
 - 49 MASSON, J C, and OCHSENHIRT, N C Squamous cell carcinoma arising in dermoid cyst, 3 cases Surg Gynec & Obst 1920 48 702
 - 50 MAYER, K Lin nach dem Sigmoid perforiertes Dermoid Zentralbl f Gynaek, 1930 54 2328
 - 51 MEIGS, J V Tumors of the Female Pelvic Organs p 794 New York The Macmillan Co, 1934
 - 52 MERIEL, E and DIEULAFAE, R Epithélioma ovarien développé sur un ancien kyste dermoïde avec épanchement séreux en kyste Gynec et Obst, 1935, 31 720
 - 53 MILLOT, J I, and HINARD, D Kyste dermoïde de l'ovaire avec épithélioma spino-cellulaire Ann anat path et anat norm medico chirurg, 1934, 11 632-634
 - 54 NOVAK E Beitr z path Anat, vol 45 Cited by Cordon, O A loc cit
 - 55 PICK Zur Kenntniss der Teratoma Blasenmolleartige Wucherung in einer "Dermoid" Cystes des Eierstockes Berl klin Wchnschr, 1902 No 52
 - 56 POLAK, J Quoted by Gordon, O A loc cit
 - 57 PUHR L Petefeszék ritkabb dermoidrakja Orvosi hetil, 1934, 11 632
 - 58 REPPUN, KARL Ueber einem Fall von Carcinoma toeser Degeneration einer Ovarialdermoidcyste Muenchen B Heller, 1911
 - 59 ROKITSANSKY Cited by Adams, loc cit
 - 60 ROSSIE L Centrabl f Gynaek, 1912, p 36
 - 61 SENN, N Pathology and Surgical Treatment of Tumor pp 632 and 647 Philadelphia W B Saunders Co 1895
 - 62 SONNATAG, E Vortauschung eines Uretersteins im Roentgenbild durch Zahnkeim in Ovarialdermoid Fortsch a d Geb d Roentgenstrahlen, 1920, 27 324
 - 63 SFAULDING Cited by Frank loc cit
 - 64 SPILLMAN R Dermoid cysts, roentgen observations Arch Surg, 1929, 18 1295-1303
 - 65 SROUT, A P Human Cancer p 413 Philadelphia Lea & Febiger 1932
 - 66 WEINER, S A study of the complications of ovarian tumors Am J Obst, 1915, 72 209-244
 - 67 WILMS, V Arch f Gynaek, 1900, 61 203
 - 68 YAMAGAWA Arch f path anat, 1897, 147 09

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF ROCHESTER

THE PROBLEMS OF UNILATERAL HARELIP REPAIR

FORREST YOUNG MD Rochester New York

THERE are few conditions in which the possibilities are so little realized as in the repair of harelips. The average repair of a harelip leaves a child so marked that it is perfectly evident to anyone that the individual is not as you and I. If we were to analyze just why we know the person has something wrong with his face we would undoubtedly find it difficult to say where the fault is. Nevertheless, if you reflect that all of us can recognize countless individuals entirely by their facial make up, it becomes evident how very sensitive the human eye is to only the slightest differences in facial ensemble.

The ideal then, in repairing a harelip is to produce a face which will to the casual observer, bear no stigmas of the original fault. This I may say is a most difficult task and a result not often obtained but by dint of hard work and experience, a thing which can be fairly closely approximated. To the highly critical eye none of them will be perfect but some will be acceptable.

I think that the secret of such an acceptable result is that the face be normally contoured. By this I mean that the features of the mid face be in correct proportion and position, and above all symmetrical. For there is nothing more obvious than an abnormality due to asymmetry. Scars can be forgotten if the lip and nose are symmetrically assembled, but if they are not, our eye immediately dissociates the component parts and the lip and nose unfold into the original condition. If one can stand a few feet away, so that the scar is obliterated and not be conscious that something is wrong with the nose or lip, then the result is probably as good as can be attained by any means of correction which is at present at our command.

The deformity. I like to consider a harelip as presenting three separate deformities. First, the separation of the maxilla, which may vary greatly. There may be in slight notching of the lip a normal contoured maxilla with the only fault being absence of the lateral incisor tooth in line with the

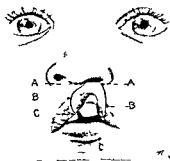


Fig 1

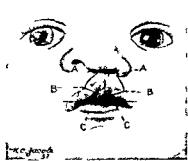


Fig 2

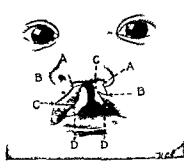


Fig 3

Fig 1. Rose type of operation. The incisions AC and AC are equal in length and to the desired vertical height of the lip. BC equals BC.

Fig 2. Thompson type of operation. ZN is the desired vertical height of the new lip. 1A is the measured width of the vermillion. 1B equals 1B equals 1Z. BC equals BC equals ZY.

Fig 3. Mirault type of operation. A is placed on mucocutaneous line at point where the line through the base of

obliquely placed columella meets vermillion. AC is a little greater than the desired vertical height of lip because this line will pass obliquely from nostril to mid point of lip when repair is finished. B is half way between A and C. ABC equals ABC and is planned so that point meets point. CD equals CD and when completed passes obliquely across vermillion in reverse direction to ABC. This staggered effect helps to disguise the scar. There is less material sacrificed by this plan than any other.



Fig 4 This child was 4 months old when operated on. Photograph at left was taken the day before operation and shows that there is merely a tiny cleft in the vermilion, hardly even a scar extending up into the lip proper. The nose is normal. At right, the child 3 months later. The lip is good. This was done by just making a V freshening of the cleft and suturing it with a little fullness of the lower edge of the vermilion. This child is shown to illustrate the fact that even as simple a notch as this can be made more pronounced by an operation which does not leave a fullness at the suture line. I have now come to believe that it is better to leave an excess and later excise it horizontally to get a smooth lip rather than run the chance of the notch recurring as the scar contracts. In this child, the fullness left just took care of the contracture.

cleft there may be only slight indentation of the inferior edge in line with the separated lip, and so on until we reach the most marked deformity with wide separation of the maxilla and forward projection of the premaxilla on the uncleft side.



Fig 6 A 10 months' old child with an incomplete cleft of lip. Notice that although the cleft extends only about half way into the lip, the nostril above it is broad and flat and the columella is obliquely inclined to the right. This is practically always so, and must be corrected. The maxilla is only partially cleft, but the left maxillary central incisor due to there being no lip over it, has grown in a rotated and angulated position. In the repair this tooth was extracted and the nostril narrowed. At right photograph 1 year later shows an average result. Note that the nose is well placed but that the two nares are not of the same configuration. This is because the lower end of the left ala was not rotated inward, but was brought directly across.



Fig 5 Left, the pre-operative photograph of a 3 months' old baby born with an incomplete harelip. There is also a partial cleft of the maxilla. The palate is normal. This illustrates again that the nasal deformity is practically always present even though the cleft of the lip extends only about half way into it as shown here. For some reason I did not get this nasal deformity corrected at first operation. When the child was a year old, a diamond shaped piece was removed from the floor of the nostril and lip, so that the columella and ala were brought into approximately normal position as shown in right photograph. The mother says that now she has practically forgotten that her child had ever had a harelip whereas before she was constantly being asked by her friends why the baby's nose was deformed.

Second, there is the cleft in the lip. At first sight, it would seem that these were all alike, varying only in whether the split extends completely into the nostril or only part way through the lip. This is true for the most part, but in a good many instances there is considerably less available vertical length of lip on the cleft side.



Fig 7 Left photograph shows a 3 weeks' old infant with the characteristic deformity of an incomplete cleft of the lip, but a complete cleft of the maxilla. At right 6 months later is shown the result obtained by the Mirault operation. Notice the normal nose with no flattening the ala curls inward at the bottom, and the columella in midline. This is one of the cases recently done, and in which a crescentic excision of skin was done on the superior aspect of the ala to correct overhang as advocated by Blair. When the right picture was taken, the arch was already normally contour.



Fig 8 This case is shown to bring out two points. First that even though repair is done late the cleft in the jaw will usually be closed by the growth process when the molding pressure of a lip is over it. Second that unless the soft parts are draped in normal fashion over the underlying bony and cartilaginous framework there will be no tendency of the nasal deformity to correct itself. Left: Condition when the girl was presented at the age of 2 years. The nasal obliquity is marked and the jaw cleft is wide open. Right: 6 years later. The alveolar ridge although it does not show in the photograph is reconstituted and there are teeth in it which occlude well. This has occurred following original repair of the lip at which time nothing at all was done to the bony cleft. Moreover a lateral view shows normal position of the upper face with relationship to the chin. The nose however I did not get in midline of the face and it is still inclined a little to the left and the right nostril is not symmetrical with the left. This deformity of the nose could and I think should be corrected but the family are satisfied. When the girl gets of age she probably will want something done. It is my experience that parents oftentimes prevent deformities being corrected which the patient when he can make his own decisions is anxious to have eradicated.

than on the uncleft. This should be carefully looked for and be considered in the repair, for a slight discrepancy in vertical height of the lip on the two sides, i.e., distance from ala to mouth line, is quite noticeable in the finished product.

Third, the deformity of the nose, is, I feel, the most important of the three and varies most widely. There is in all unilateral harelips excepting those which are barely notches in the lip line, abnormality in contour of the nostril on the affected side as well as malposition of the nose as a whole. The nose is shifted to the side opposite the cleft. The columella lies obliquely inclined from above downward toward the sound side so that a line through the base of the columella is not in the horizontal plane, but an oblique one. The nostril in the extreme case may be drawn out into a flat line with the lining of the nares in its lateral aspect flush with the cheek and lip surface, and in such instances, may be mistaken as a part of the



Fig 9 This infant was 7 weeks old when first seen. His doctor wrote to me when he was 6 weeks old asking how soon the lip should be repaired as he was under the impression that one waited until the child was 2 or 3 months of age before doing anything. Left photograph was taken 2 days before operation the child being 9 weeks old. One notices that this is a cleft of lip and maxilla without cleft of palate. There is rather marked projection of the premaxilla. The nose is fairly well in the midline the obliquity being mainly in the columella. The left ala is of the flat type with a rolling out of the outer portion so that one is actually looking at nasal lining. I think that this fact is often not appreciated so that in the repair this lining is brought over to the columella rather than being rolled inward after complete mobilization and the true base of the ala brought inward in normal position. In repairing this the maxilla was molded inward by digital pressure. Both cheeks and columella were loosened subperiosteally from maxilla more so on left through intra oral incisions. The left ala was cleanly cut from its lateral attachment up to the nasal process. I tried in this child making an incision along the left base of the nasal septum freeing the mucosa and suturing the cut edge of lining of left ala to this. The lip was done by a modified Mirault operation but as one can see in right photograph at age of 7 months this made the left nostril too small although well shaped and in correct position. The obliquity of the nose is corrected. The lip is not good the vermilion being poorly matched and not even. The arch at this time was perfectly normal in contour. The lip should and will be readjusted. If one measures from ala to lip there is a shorter distance on the left. This is not very noticeable but is a fault of the Mirault operation which I have found hard to overcome.

lip. The lateral base of the ala may have very little form almost blending with the cheek.

The repair. The successful repair of a harelip must overcome the abnormalities mentioned. The cleft in the bone can be disregarded, for there are very few jaw splits which will not close from the pressure of the repaired lip and its constant muscular play, even though the repair is done relatively late (Fig 8). The so called Brophy operation, actually done years before Brophy's popularization of it, is unnecessary and deforming. The wiring of the jaw split destroys or deforms tooth buds often causes later retrocession of the upper face, and is, moreover, attended by some



Fig 10 This child is shown to illustrate the fact that the Rose type of operation gives a lip which is too long in the vertical plane. I call them "horse lips." As can be seen in left photograph, the deformity is a right, unilateral cleft of lip, jaw, and palate. There is not very much nasal obliquity. This case was done some time ago and a preliminary wiring of the upper jaw was done at age of 2 months. When the infant was 4 months old the lip was repaired. When 2 years of age the palate was repaired by the Langenbeck procedure. Right, Photograph showing the appearance at 2 years. Fortunately, there is no retrocession of the maxilla. I no longer use the Brophy wiring depending on the repaired lip to close the jaw cleft as the child grows which it practically always does.

hazards (Fig 15). Although I am perfectly well aware that very few men doing oral and plastic surgery any longer use forceful closure of the alveolar cleft, I do not feel that I am jousting with windmills in bringing up this point, for the rank and file of surgeons still do. I still see children



Fig 12 The baby, as can be seen in left photograph is one of the type that just missed having a double harelip. There is a complete cleft of lip, jaw and palate on the right. On the left there is a notching on the lip, and a "union" scar extending up into the nostril. There is the usual drawn-out ala on the right with obliquity of the columella. Repair was done at 7 weeks and right photograph shows the result 2 weeks after operation. This is a Mairault repair and the nose is a good one. The lip is also good. The small notch is the incomplete cleft on the left, and will be smoothed out at the time of palate repair.



Fig 11 This is another of the wide open clefts of lip, jaw, and palate. The deformity is of the same type, although not quite so marked as in Figure 14. The lining of the ala on the left side is not facing outward as much. Right photograph shows a good result from the Thompson type of operation. The ala has been rotated in correctly, but there is an overhang of the superior part of the alar cartilage. This probably could have been corrected by a crescentic excision of skin just above the overhang, as recently advocated by Blair.

brought for correction of a backward displacement of the upper lip due to closing forcibly the alveolar cleft in infancy. It is an extra, unnecessary, and harmful step in the repair of a harelip.

Strange to say, the cleft of the lip which most people would say is the conspicuous part of the



Fig 13 The baby's parents had been advised by their family doctor to "wait awhile" before having the lip repaired so that when I first saw the boy, he was 8 months old. The deformity as shown in left photograph is a very marked one. I closed the lip over the wide open premaxilla by a Thompson type of operation. This worked excellently for about 2 weeks, and then the ala slipped down into the bony cleft. This occasionally happens in spite of every effort by careful suturing to prevent it. I repaired the palate at 18 months and at 2 years of age corrected the nasal deformity which had resulted from the ala slipping at original operation. In spite of the delay in lip closure, the alveolar ridge is normal in contour. At right, 2 weeks following final operation on the lip, the recent suture line is visible. This will disappear in a few months.

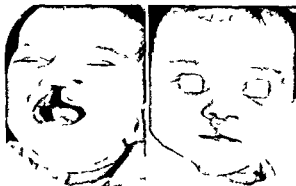


Fig 14. Left. The familiar marked deformity of a complete unilateral cleft lip, maxilla and palate. At first sight this seems much harder to repair than an incomplete cleft lip and it is. But I had rather repair one of this type than one such as shown in Figures 6 or 7 because I know that I will work harder to get an approximately normal nose and lip and the deformity is so marked that the parents will be grateful for something a little less than perfect which unfortunately is practically always the case. If the pre-operative photograph is analyzed it will be found that everything for a normal lip and nose is present but badly arranged. The columella lies obliquely to the left of the midline. The right ala is almost a flat band with the lateral lining everted. The cleft in the maxilla is so wide open that when the right nares is constructed in the right position there will be no foundation for it to rest on. It is this last point that undoubtedly first caused Brophy and others before him to wish to reconstitute the alveolar arch before uniting the lip. This however I do not do because of the later deformity of the maxilla which often follows forcible wiring of the arch. It is true that occasionally the reconstructed nostril will slump down into the cleft of the arch but this can usually be avoided by careful internal suturing of the soft parts. In case it does occur it can be corrected by a second operation as in Figure 13.

In this case after digital molding of the maxilla a wide mobilization was done on both sides—on the cleft side practically to the rim of the orbit. In these mobilizations one often sees the infra orbital nerve plainly and I often sacrifice it if it seems to hold the cheek. Incisions of a modified Mirault operation were made and the repair completed. The postoperative view is 2 weeks afterward so that the scar is still prominent. The nose is about as good as one gets. The nostril is correctly shaped the ala curves in normally and the floor of the nares is at the right level. The columella is exactly in the midline. The lip is not quite so good but the distance from ala to vermillion on either side is equal the most difficult part of this type of repair.

deformity is the least difficult to repair acceptably. There are certain points about it which should be kept in mind, and if these are paid attention to a fairly normal lip should be obtained. These are: The vertical height of the lip on the two sides should be equal. This height should not be too great, or an inartistically long upper lip will be the result. The vermillion edge should meet smoothly on the same plane. The "mouth line" (junction of lips when closed) should be



Fig 15. The way a child should and should not look following repair of a unilateral harelip. Left. Infant 6 months following simple closure of lip over a wide open alveolar cleft. Notice the normal full pouting lip of a baby. The alveolar cleft has closed leaving the normal baby arch. Right. A child 7 years old as I first saw her. She had been operated on five times. The maxilla is markedly retroceded. Many of the upper teeth are absent and those that are present are malformed. The upper lip is drawn tightly across the small upper jaw. The right side of the nose is completely obstructed by a deviated septum. This is so marked that the right nasal bone is actually being shoved outward. This is all due to loss of maxilla either from forcible closure of alveolar cleft or actual excision of bone in infancy. The five previous operations and the four which I had to do to make her somewhat presentable could all have been avoided by a simple closure of lip in infancy in accordance with the physiology of growing infant bone. Moreover the end result would have been better.

smooth without notching or an excess "blob" at the suture line.

A considerable number of operations have been devised in the past for harelip repair. The most common of these are the Rose, Thompson, Owen, and Mirault operations. I have used all of these except the Owen operation. They all have some inherent defects in plan.

The Rose operation (Fig 1) is the simplest of all. As shown in the diagram, it is a simple cutting away of the vermillion surfaces of the cleft along with considerable lip tissue. The points to be kept in mind in making these incisions are that the two sides be equal in length, that the finished distances AB and $A'B'$ are equal, that the cuts across the vermillion BC and $B'C'$ are equal, and that the point at which the cuts are widest apart be equal in width to the cleft. The inherent fault of the operation is that it usually produces an upper lip which is too long to be artistic in proportion (Fig 10). And I feel that any repair that leaves a straight vertical scar down the lip, leaves more of a stigma than one in which the scar is oblique or staggered.

The Thompson operation is also simple to execute (Fig 2). It is based on principles similar to those of the Rose operation. It recognizes that equal vertical height of the two sides of the lip is essential, and attempts to obtain this by accurate measurements.

The points A and A' which are to be joined to form the floor of the nostril are marked. From these approximated points a measurement is taken vertically downward, so that the point λ lies on an imaginary line which would complete the natural curve of the lip. Using this measurement minus ZX (the width of the vermillion) the points B and B' are marked at junction of the skin and mucous membrane. The points C and C' are then marked so that the angle ABC is about equal to or less than 90 degrees and BC equals $B'C'$. This gives raw surfaces which are exactly equal and moreover equal to YX .

The fault of this operation in my experience is that although easy to carry out, it usually produces a lip which is too tight along its lower border. Moreover, it does not provide an adequate nostril floor and with subsequent contracture of scar, the nostril is pulled downward.

The Mirault operation (Fig 3) as originally devised consisted in the principle of turning down a small flap of tissue from the cleft side of the lip into the middle of the finished lip. This principle has been criticized at various times because it displaces muscular tissue into an abnormal position, and from this, it has been argued that abnormal expression would occur on muscular movement. In practice, I have never seen this occur. The operation, I think, is sound because it sacrifices practically no tissue, and instead, places tissue which is usually sacrificed in other plans in the position where it is most needed, namely, along the lower border of the lip. It thus produces a lip whose vertical height is more nearly normal than any other plan, and which is not tight along the vermillion line. It also conserves tissue with which the nostril floor can be reconstructed.

The diagram (Fig 3) is self explanatory. The distance AC is measured, so that it is a little more than the desired vertical length of the lip. It is then divided by placing the point B half way between A and C . The line $A'B'C'$ is made equal to these distances. D and D' are placed so that the distance CD equals $C'D'$. Both are cut obliquely. The two incisions then fit together like a jigsaw puzzle, point to point.

The operation has been refined by Blair especially to take into account the nasal deformity. I have found two difficulties in his plan. It is difficult to produce a smooth vermillion line and

to prevent the vertical height of cleft lip from being less than of uncleft lip is a problem.

The nasal deformity. I have come to feel that the problem of repairing a harelip is really one of producing as nearly a normal nose as possible. When one considers that the nose is the most prominent feature of the face, and that slight deviations from the normal are extremely noticeable, this point of view I think will be justified. To be an acceptable nose, the following things must be so. The nose as a whole should be in the midline, the columella must be vertical to the mouth plane, the nostril floors should be on the same level, the nostrils should be approximately the same shape and size, and for this to be so the ala must curve inward at its base, with no overhang or buckling of the superior alar border.

To accomplish such a result is not always possible, but one to be striven for. In order to correct the nasal deformity, there are certain things which must be done. Unless the cheeks and alae on both sides are completely loosened from the maxilla, it is futile to attempt to correct the deformity. The columella must also be loosened from its bony and cartilaginous support. The shape and position of the nostril depend upon the points on either side of the cleft selected for approximation, and the floor of the nostril will be correct if tissue is saved with which to construct it.

OPERATIVE TECHNIQUE

Ether vapor fed through a hook in the corner of the mouth is the most satisfactory anesthesia. The terrain is then carefully surveyed and the incisions planned. Of prime importance is the selection of points A and A' , for on their proper placement depends the final configuration of the nose. A is placed on a line passing obliquely through the base of the columella and perpendicular to a line bisecting the columella longitudinally. Its exact location on this line requires some consideration, but is usually just inside the mucocutaneous junction A' , I believe, is often wrongly selected especially in those instances where there is eversion of the alar lining. It should be just inside and a little below the true lateral border of the ala. If these two points are selected correctly on approximating A and A' , the ala does not look as though it had been dragged over to meet the columella, but will curl inward in normal fashion.

When determined, these two points are temporarily tattooed in the skin with methylene blue on a needle. The denuding incisions are then planned and measured, always with the thought in mind that the two sides must be equal in length and equal to a line dropped vertically from nostril

floor to lip on the sound side. These incisions (or points along them) are tattooed in like manner.

The next step is freeing the cheeks, alæ, and columella from the framework. This is done through intra oral incisions on either side. I would like to emphasize that this mobilization must be done on both sides, and not just on the cleft side, otherwise a nose displaced from the midline will result. The greater the deformity, the wider the freeing of soft parts must be, bleeding from this step should be controlled by warm packs and pressure. When the soft parts have been so loosened that the nose can be correctly oriented and cleft edges approximated without any tension, the mobilization is considered sufficient.

The next step is making the lip incisions. The direction and course of these depend on the plan and type of operation. They are made with a sharp, pointed knife inserted perpendicularly through the lip. On the medial side of the cleft, the incision is made from above downward to the vermilion border, all the vermilion being left attached until decision is made as to how much of it will be used. On the lateral side, incision is made from *A'* to vermilion border and then along mucocutaneous line upward until the knife emerges in the cleft. This leaves all the lip tissue attached as a flap to ala and vermilion to lip. It is important to conserve all tissue until the lip is approximated. The raw edges are now approximated by a trial suture placed at 4—*A'*. The flap of lip tissue attached to ala is rotated upward and trimmed to form the floor of the nostril. The vermilion flaps are trimmed to form the lip. If any change in plan is necessary, it is made at this time before the conserved tissue is trimmed. Approximation is done with interrupted silk tied on the mucous surface, and interrupted horse hair on skin surface. Silk has enough tensile strength to hold the repair securely while horse hair causes little skin scar. A Logan bow is kept on for a period of from 10 to 14 days to keep tension off the healing wound.

POSTOPERATIVE CARE

These infants are always grouped and matched before operation and if condition at end of operation seems at all doubtful a small transfusion is given immediately. Feeding is started as soon as the infant is conscious. This is given with a medicine dropper. If there is any weight loss due to taking formula poorly for the first few days, small saline infusions are used to keep up body fluids.

After various ways of caring for the lip were tried, the following simple method was evolved. No dressing is used. Hands are restrained. For the first few days as crusts of dried blood form they are removed with hydrogen peroxide. If there is any redness along the wound, tiny sponges soaked in warm saline are placed on the lip frequently. The skin sutures are removed in 48 hours to prevent scarring. As soon as these sutures are out, zinc oxide ointment is applied to the lip twice daily. The nostrils are kept clean with tooth pick swabs. The Logan bow is left on for 2 weeks, and the internal silk sutures are not removed until the third week. Feeding from the bottle is started after final sutures are out.

The baby is sent home with no instructions to the mother other than those of feeding. The baby should be seen every few months for a year and a half, and if any secondary corrections are necessary, these should be done before fixed deformities result. Orthodontia is practically always necessary later, as the upper incisors rarely are in normal position. Most of these children have some deviation of the nasal septum with obstruction to breathing on side opposite the cleft when they get their growth. This can be attended to then.

THE OPTIMUM TIME FOR OPERATION

There is rather general agreement that harelips should be repaired as soon after birth as possible. Many men believe that operation should be carried out within the first 48 hours after birth. I am not in quite such a rush as this. I think the optimum time depends more on how the baby takes feedings and gains weight. There are a few babies who nurse poorly and fail to gain until the lip is repaired. Most of them have difficulty for a week or so, but soon learn how to suck a large nipple with big holes successfully. If the baby thrives, I would just as soon wait until 4 to 6 weeks before operating. There is less operative mortality and more lip to work with at this age. The premaxilla will still be successfully molded by the lip even after 2 months. However, I see no point in waiting more than 6 weeks, and feel that the family physician should instruct the parents to have repair done in the first month.

The child should be in good physical condition, especially the upper respiratory tract, before operation. A running nose is a definite contra-indication to repair. Blood should be available for transfusion as it is occasionally needed immediately after operation.

REPAIR OF TRAUMATIC FISTULAS OF STENSON'S DUCT

HAROLD GLASCOCK, M D, and HAROLD GLASCOCK, Jr, M D, Raleigh, North Carolina

THE repair of fistulas of Stenson's duct comes to few surgeons who do not deal with large numbers of traumatic cases. Yet it is a problem which may suddenly confront any surgeon. It is fortunate that accidents to Stenson's duct are not frequent because its repair is difficult and cosmetic effects must seriously be considered.

The following case is being reported because we have had excellent results with a modification of the technique described by Homans. We are familiar with the technique of end to-end suture by extension of the incision along the duct as well as the various techniques of Kaufman, Nicola-doni, Braun, and Langenbeck. All of these usually produce large scars in addition to the lesion already present. Our method is not radically new, but we believe that may serve well in those cases in which early operation follows division of the duct.

Our method consists of passing a metal probe from the buccal opening through the distal portion of the severed duct, the probe coming out through the wound in the face (Fig 1). A thread is then wrapped around the end of the probe, both ends of the thread being left long. The probe is pulled back through the duct, thus drawing the loop of thread into the mouth. The end of a piece of extra coarse silk worm gut is then bent and hooked into the loop of the thread and the thread is then pulled back through the distal end of the duct, the silk worm gut being drawn with it.

The patient is given lemon juice to stimulate the flow of saliva and in this way the proximal end of the injured duct is found. The same probe is inserted into the proximal end of the duct, passed to the parotid gland, and forced through the substance of the gland. Where the probe points the skin is nicked sufficiently to come through to the surface. The thread is again wrapped around the probe and pulled through the proximal end of the duct to the wound. The same piece of silk worm gut is hooked in the loop of thread, and the thread is drawn through the proximal end of the duct and parotid gland, the silk worm gut being pulled with it. This places the silk worm gut completely through Stenson's

duct and the parotid gland. To hold the silk worm gut in place, a shot is applied at each end. The wound in the face is sutured tightly with horsehair.

The wounds are cared for in the same manner as are any other wounds of the same nature. The silk worm gut is left in place for a period of 4 to 6 weeks, thus encouraging the formation of a wide channel.

Following is the report of a case.

CASE REPORT

G J, negro male, aged 30 years, received a vertical laceration about 3 centimeters in length on the left side of the face just below the malar eminence. The wound bled rather profusely. He was taken to the hospital. Hemorrhage was controlled by means of ligatures and the wound was closed with the hope that the duct had not been injured. However, the following day the patient reported that the dressing became very wet following each meal.

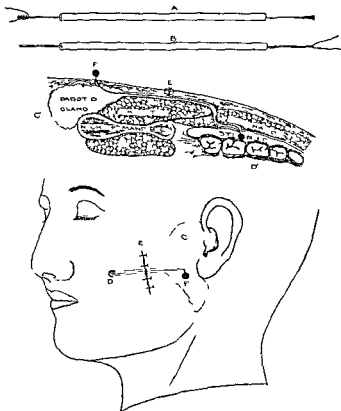


Fig 1. A, Probe passed through duct with thread wrapped around the end to be pulled through the duct. B, Silk worm gut hooked on the thread to be pulled back through the duct. C, C', Parotid gland. D, E, and D', E', Shots on the silk worm gut which has been passed through Stenson's duct and the parotid gland. E, Sutured wound.

Hence injury to the duct was established beyond doubt. It was decided to allow the wound to heal and see if the fistula would close of its own accord. The seromucous discharge continued and surgical repair was decided upon. The existing wound was opened under local anesthesia and the technique described was carried out. Saliva began to follow the silkworm gut into the mouth almost immediately. No saliva came through the proximal opening in the skin behind the gland and very little through the repaired fistula site. There was only slight interference with the patient's comfort. The silkworm gut was removed 4 weeks following operation. Only the scar of the laceration and a very small scar where the silkworm gut was brought out at the gland exists.

In a follow up after 1 year the patient states that the gland and duct are functioning normally.

CONCLUSION

- 1 A modification of Homans' method for repair of traumatic fistulas of Stenson's duct is reported
- 2 The bringing of the silkworm gut out through the gland is an important part of the technique

REFERENCES

- 1 BICKHAM. Operative Surgery Vol. 3 p 528 Philadelphia W B Saunders Co 1924.
- 2 DOYEN Surgical Therapeutics and Operative Technique Vol. 2 p. 30 Philadelphia and London William Wood & Co 1917
- 3 HOMANS. Textbook of Surgery p 574 Springfield, Ill. Charles C. Thomas 1931

THORACOPLASTY WITHIN THE SANATORIUM

PAUL D. CRIMM, M.D., F.A.C.S., DARWIN M. SHORT, M.D., and
CLARENCE S. BAKER, M.D., Evansville, Indiana

NUMEROUS institutions caring for the tuberculous sick are located a great distance from clinics and medical centers where thoracic surgery is performed. It therefore becomes desirable for certain of the sanatoria to add the necessary surgical procedures to their armamentarium, if in the future they are to continue operation in the full interest of patients affected with diseases of the chest.

It is advantageous to do surgery in the same institution because long periods of bedrest are required between minor collapse procedures, which are essential before major surgical collapse is instituted. The pre-operative and postoperative care can be followed intimately and more understandingly in the institution where tuberculosis is treated and all facilities are available to meet the vicissitudes of the tuberculous patient. If the patient is moved to a general hospital his stay must be, of economic necessity, as brief as possible. The patient is oftentimes returned to the sanatorium where follow up supervision by the surgeon is unwillfully neglected.

In this series, 180 operations were performed on 100 consecutive patients with pulmonary tuberculosis. Ages ranged from 16 to 65 years. Fifty-six were women and 44 were men. The operative mortality was nil. There were no postoperative deaths earlier than 4 months. All patients were hospitalized in the sanatorium and thoracoplasty was the final operative procedure indicated. This was instituted in an endeavor to prevent them from being permanent bed patients, or continuing throughout life as infectious hazards to their families and communities.

ANALYSIS OF CASES

Of the 100 cases, 24 were moderately advanced and 76 were far advanced cases of pulmonary tuberculosis. Sixty cases had cavities at least 3 centimeters in diameter, while 26 cases had smaller but generally multilocular cavities. In 14 cases, if cavitation was present, it was hidden by dense infiltration, frequently of long duration. Five cases had cavitation in the lower lobes. There were 2 cases with bilateral cavitation in the upper lobes. Seventy cases had infiltration in the contralateral lung ranging from a minimal lesion

to moderately advanced. Eight had a few areas of calcification in the contralateral lung, which were of the primary type. The 22 cases remaining had no evidence of disease in the opposite lung, either by x-ray or physical examination. In 12 per cent of the tuberculous cases admitted to this hospital the patients were ultimately recommended for thoracoplasty.

Positive sputum prior to thoracoplasty was found in 94 per cent of the cases. To date 80 per cent of the 94 patients with positive sputum, who are now living, have a negative sputum, 11 per cent continue to have a positive sputum.

Nine per cent of the 100 cases are deceased over a 4 year period. Four of the nine deceased had a negative sputum prior to death. The various causes of death are as follows: brain abscess, 1, chronic nephritis, 1, typhoid fever, 1, and 1 committed suicide following a postoperative psychosis. Of the 5 who had a positive sputum prior to death, 3 died of tuberculous pneumonia in the opposite lung, 1 of tuberculous tracheobronchitis, and 1 of self-destruction (Table I). Of the 91 patients living, 5 have no activity other than bathroom privileges, 27 have limited activity, and 59 are working (Fig. 1).

In this series there were 45 patients who had received pneumothorax prior to thoracoplasty. The duration of the collapse in these cases is as follows: 28 cases for 6 months or less, 10 cases, 6 months to 1 year, 3 cases, 3 years, and 1 case for 5 years. Of the total number of patients receiving pneumothorax, 53 per cent developed fluid and 9 per cent pyopneumothorax. Except for one, none of these pneumothorax cases manifested a negative sputum following this form of therapy. In 1 case the pneumothorax was of 5 years' duration, which rendered the lung unable to re-expand and a thoracoplasty was indicated to obliterate the pneumothorax cavity.

Pneumothorax in the opposite lung is indicated in any early spread of disease, in spite of the fact that a spontaneous collapse may be a complication. The risk of spontaneous collapse is far less than that caused by an extension of the disease and ultimate death. In 5 of the cases reported patients are now taking pneumothorax in the opposite side and of this number 4 have a negative sputum. Pneumothorax was started in 1 case

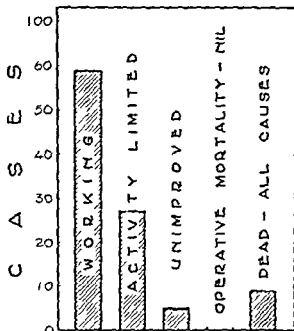


Fig. 1. Postoperative results in 100 cases of thoracoplasty (180 operations) over a 4-year period.

in opposite lung 1 year in 1 case 2 years in 1 case 4 months in 1 case 2 months after thoracoplasty.

Phrenic nerve operations were performed on 11 per cent of the cases. Four patients had a phrenicectomy 2 years prior to thoracoplasty, 3 cases 6 months prior, 1 case 1 year and 1 case 1 month. In the authors' opinion it is doubtful if any of these patients were benefited by the phrenicectomy. From the senior author's experience and results it is believed that phrenic nerve interruption is not necessary in the majority of patients with tuberculosis. If possible a partial pneumothorax is a much wiser preparation for thoracoplasty than phrenic nerve operation. Permanent interruption of the phrenic nerve diminishes vital capacity which cannot be replaced when it is needed in the future management of the case.

There were 3 cases of bilateral thoracoplasty performed after the method of Allen, and 2 of these had a subsequent parafin plombage on one side in preference to resecting further lower ribs and reducing the vital capacity. Parafin plombage, in our opinion, has a very definite place in completing the closure of residual cavitation. By this method the patient can still have the advantage of a partial thoracoplasty with conservation of vital capacity. Adequate collapse with minimum reduction of vital capacity should be the operator's prime consideration.

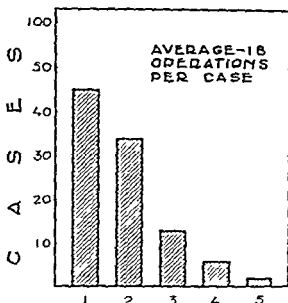


Fig. 2. Operations according to stages in 100 consecutive cases of thoracoplasty.

Of the 180 operations, 153 were performed from the posterior approach and 27 anterior thoracoplasties and costectomies were performed before or after the posterior operation. The anterior operation is advantageous as a primary operation. It gives the surgeon an insight as to the operative risk of the patient. It oftentimes reduces the production of sputum. It permits a greater number of ribs to be removed *in toto* at the second or posterior operation. Frequently it is necessary to wait several months before a second posterior operation is performed, whereas it is seldom necessary to wait longer than 2 or 3 weeks after the anterior operation. In our experience many patients can withstand an anterior operation of four costal sections followed in 2 or 3 weeks by five posterior sections much better than they can tolerate the entire first three ribs being removed during one operation. Forty-five patients had a one-stage operation at which time three to five ribs were removed occasionally six but seldom seven. Thirty-four patients had two operations with removal at the second operation of three to five ribs but seldom six. Thirteen patients had 3 operations, 6 had 4, and 2 had 5 (Fig. 2). Numerous stages were necessary because insufficient collapse resulted from the prior operations. In these cases either regenerated ribs were resected or else the patient had empyema which necessitated the removal of regenerated ribs and parietal pleura. Only a small area of pleura and rib was resected.

at one time, which in turn diminished the operative risk

COMPLICATIONS

Pneumonic consolidation of the lower lobe (operated upon side) due to bronchiogenic spread following an upper stage operation was manifest in 3 cases. After the disease in the lung operated upon was apparently arrested 5 patients developed active infection in the opposite lung. Two of these had no previous evidence of infiltration. Four responded to pneumothorax in the opposite lung and 1 died, due to delay in seeking medical advice. One case had a marked shift of the mediastinum and extreme dyspnea and tachycardia, with stabilization in 4 days. The raising of tenacious sputum was a serious complication in 1 case which had a tuberculous tracheobronchitis. The absence of contralateral pneumonia in this series, in the writers' opinion, can be attributed to meticulous care as regards preoperative drainage, choice and administration of anesthetic, and the duration of the operation.

In many cases a slight injury to the brachial plexus was manifested after the posterior upper stage. This was evidenced by hyperesthesia or paresthesia along the medial surface of the arm, forearm and hand. These symptoms disappeared, usually within a week, and without residual. Five patients experienced pain because the tip of the scapula became impacted beneath the adjacent ribs. This either disappeared or was remedied at subsequent resections. Two patients developed a mild wound infection. Delayed healing of the wound due to aseptic necrosis of the skin on the axillary side was experienced in 15 cases. Stitch abscesses occasionally occurred but were of no consequence. There was one acute genitourinary infection which rapidly subsided.

A pleuroesophageal fistula with massive empyema existed in 1 case. Subsequently this was successfully closed following the second stage. One patient became critically ill with amebic dysentery 2 days following operation. This was controlled with emetine therapy. Another patient developed a periodic tic of the diaphragm the second day after operation, first stage, upper. Respiration was atypical, resembling a Biot type. The administration of carbon dioxide gave some relief with total disappearance of the symptoms in 18 hours.

A majority of the patients exhibited signs of mild shock, the systolic blood pressure dropping to 100 to 80 millimeters mercury, depending upon the anesthesia. Cyclopropane causes a slightly greater fall of the systolic pressure than does nitrous oxide-oxygen. The use of cyclopropane is

a distinct advantage for the following reasons: (1) better relaxation with a wider margin of safety is possible, without increasing the respiratory embarrassment, (2) no restriction of oxygen is necessary to maintain a profound anesthesia as is the case with nitrous oxide-oxygen, (3) a large percentage of oxygen with a small measured quantity of cyclopropane maintains good anesthesia, without marked changes in blood pressure during operation.

In this series, 2 patients required blood transfusions after operation, although routinely 2,000 cubic centimeters of normal saline is given by hypodermoclysis immediately after every operation. Circulatory and respiratory systems were critically checked and supported during the first 18 hours after operation. A careful examination was made before operation of the vital capacity, the cardiac and renal functions. Patients with a low vital capacity are relatively good risks, provided they are free from any myocardial or renal damage. Young patients whose vital capacity is between 900 and 1,000 cubic centimeters may be operated upon without grave risk. Older individuals, past 50 years of age, should have a vital capacity of at least 1,500 cubic centimeters if postoperative complications are to be avoided.

INDICATIONS AND CONTRA INDICATIONS

An early tuberculous pulmonary infiltration contra-indicates the employment of thoracoplasty, except in a case in which hemorrhage cannot otherwise be controlled. Such an infiltration which has been subjected to approximately 6 months' bedrest, with or without supplementary pneumothorax, usually manifests sufficient fibrosis and resolution for a major collapse. The extent, character, and distribution of infiltration must finally decide the time of operation. A tuberculous process which has tended to heal with resolution, cavitation, and fibrosis over a period of 6 months to 2 years makes the patient a far better surgical risk.

In evaluating a candidate for thoracoplasty one cannot rely on any single criterion. The most reliable criteria are the stereoscopic x-ray findings. For example, a patient may have essentially a normal blood sedimentation rate, a normal Arneith index and Schilling count, and be obviously improved clinically, but the x-ray may show a very soft infiltration which should not be collapsed until further resolution and fibrosis is evident. In advanced disease in which thoracoplasty is inevitable it is advisable to prepare the patient for that procedure as early as the above stated criteria will permit.

TABLE 1—CAUSES OF DEATH AND POSTOPERATIVE INTERVAL FOLLOWING THORACOPLASTY

Cause of Death	Interval	Cases
Brain abscess	1 yr	1
Chronic nephritis	3 yrs	1
Suicide	4 mos	1
	1 yr	1
Typhoid	3 yrs	1
Tuberculous tracheobronchitis	2 yrs	1
Tuberculous pneumonia	2 yrs	1
	3 yrs	1
Total		9

As a rule, pneumothorax should be attempted as a therapeutic test prior to any plastic operation on the chest. The information as to the presence or absence of adhesions, ofttimes cavitation, flexibility of the mediastinum as well as the response of the opposite lung can be obtained by the introduction of air into the pleural space. Thoracoplasty performed over a lung which can be collapsed with air may end disastrously with a mediastinal flutter. Thoracoplasty, therefore, is not a substitute for other collapse procedures. The use of pneumothorax, if only partially successful, hastens resolution and the development of fibrosis. Development of fluid aids in fixing the mediastinum and adhesions formed after decompression on diminish the collapse of the normal lung tissue which is proximal to the infiltrated area. Partial pneumothorax together with partial thoracoplasty on the same side in the writers' experience, is not a successful procedure, but may be used to temporize a bronchiogenic spread.

An upper partial thoracoplasty followed by a pleural plombage in the same side, if necessary, is preferable and more conservative than an upper stage thoracoplasty and phrenic nerve operation. Pleural plombage used in this manner conserves a patient's vital capacity. The operation is indicated as soon as adhesions develop following a thoracoplasty.

Conservation of vital capacity, commensurate with adequate closure of the infiltrated area, is essential in any case of tuberculosis. Tuberculosis is a disease which progresses in a series of accidents and the successful management depends on anticipating these accidents. The conservation of as much normal lung tissue as possible for any subsequent spread of infection is paramount in selecting operative procedures. For example, a phrenicectomy might assist a patient in healing a minimal apical lesion. Several years later if disease develops in the opposite lung the patient may require a pneumothorax or later a thoracoplasty, or even a bilateral thoracoplasty. The previous phrenic nerve operation has diminished the

vital capacity which now is gravely needed. In reviewing such a case one wonders if the earlier phrenicectomy was either imperative or a wise procedure. In view of such possibilities the authors are opposed to permanent interruption of the phrenic nerve unless unilateral disease demands a complete collapse. The longer one can keep both diaphragms intact the more surgical procedures the patient is able to withstand later on. Graham states that pneumothorax is a more valuable procedure than phrenicectomy and is in the habit of attempting pneumothorax in every instance before undertaking phrenicectomy. Certainly a phrenic nerve operation should not be substituted for pneumothorax, or performed prior to pneumothorax, if the patient is to be treated conservatively. However, a permanent interruption of the phrenic nerve may be indicated in decompressing a pneumothorax and in protecting closed cavities of the re-expanded lung. It also aids in re-adjusting the mediastinum in a patient with marked contraction to the side operated upon or it may assist in eliminating pockets of empyema. In this series the procedure of Alexander has not been used. He recommends primary radical phrenicectomy and secondary resection of the upper seven ribs in order to reduce aspiration pneumonia. Generally speaking, the authors believe that far too many phrenics are interrupted without due consideration of the ultimate procedures.

In a number of cases thoracoplasty was admittedly used, not to effect a cure, but in an endeavor to improve the status of the hopeless case, by reducing sputum and toxic symptomatology. A case of long standing frequently gives an excellent result as far as the collapse of tuberculous infiltration is concerned, yet a concealed lesion in the kidney, intestine, or opposite lung may become activated in the future. The life of these patients is often prolonged, yet the results never add to the statistical success of thoracoplasty.

In collapse therapy there is too much overemphasis of single procedures which may be used in effecting the cure of tuberculosis. This overemphasis may be proportionate to the availability of the different procedures. If such is true the patient is allowed to pass the opportune stage for a certain collapse procedure just as he passes insidiously from a minimal to a far advanced stage of the disease. Too often the recommendation of a procedure like thoracoplasty comes to the patient as a last resort rather than an early aid toward a cure.

SUMMARY

1. In this series, 180 thoracoplasties were performed in the sanatorium on 100 consecutive pa-

tients with pulmonary tuberculosis There was no operative mortality

2 Of the 100 patients, 24 were moderately advanced and 76 were far advanced cases of tuberculosis Over a 4 year period 9 cases are deceased, 5 have no activity, 27 have limited activity, and 59 are working

3 Pneumothorax is advocated as a prerequisite in preparing many patients for thoracoplasty

4 Thoracoplasty with pneumothorax in the contralateral lung, when indicated, either before or after operation, is a safe procedure

5 If preliminary phrenicectomy is indicated prior to thoracoplasty, only temporary phrenic nerve interruptions are recommended

6 Pleural plombage used as a subsequent procedure to thoracoplasty diminishes residual cavitation and precludes further rib resection

7 Anterior thoracoplasty and costectomy prior to posterior thoracoplasty reduces surgical risk and lessens the interval of time between operative stages

8 It is advisable to be somewhat more radical in selecting the time for performing thoracoplasty, and in turn become more conservative in safeguarding the patient's vital capacity for future breakdowns

REFERENCES

- 1 ALEXANDER, J The Surgery of Pulmonary Tuberculosis p 166 Philadelphia Lea & Febiger, 1925
- 2 ALLEN, D S Bilateral partial thoracoplasty for bilateral pulmonary tuberculosis J Thoracic Surg, 1932, August, 587
- 3 GRAHAM, L A Surgical Diseases of the Chest p 978 Philadelphia Lea & Febiger, 1935

RESTORATION OF THE ENTIRE SKIN OF THE PENIS

JAMES BARRETT BROWN, M.D., F.A.C.S. Saint Louis, Missouri

THERE are apparently only infrequent instances of loss of the skin of the penis, but the defect is a very acute problem to the patient and the repair may present difficulties in the selection and application of suitable skin covering.

In three of the four instances recorded here, free thick split skin grafts have given permanent healing with complete normal sensation and function. In the fourth patient split grafts were used to supplement scrotal flaps and to repair the defect on the scrotum. Free full thickness grafts would give just as good results as the thick split graft, but in this area as in other parts of the body, the possibility of a full take in a contaminated field is much greater with the thick split graft than with the full thickness graft.

Pedicle flaps from the scrotum may be used to cover partial surface defects, and also where there has been damage to the cavernosum with deep scarring and contracture, so that a thicker restoration is desired than that which a free skin graft would give (Fig. 5). But the available scrotal tissue is not usually great enough for total resurfacing and, during the period of attachment of the flap, there may be too much retraction of the penis and flap, with a resultant bulky, thick surface covering. This same fault may be found with pedicle flaps from other areas, and there will, almost undoubtedly, be obtained a less normal appearance and sensitivity than the free graft gives.

The two patients whose complete restorations with thick split grafts are shown in Figures 1 and 2 had suffered complete loss of the skin of the penis following circumcision. Because it was thought best to do as little suggestive recording as possible of the unfortunate situation, preliminary photographs were not taken, but, on examination of both patients when first seen, the penis was found to be pulled up to the abdomen in a curled knot. Excessive cellulitis and sloughing were present and the patients were in extreme discomfort physically and mentally. The covering of the glans was intact in both, but there was no skin left in either except about 1 or 2 square centimeters on the ventral surface of one.

Pre operative preparation of ulcerated cases. It was determined immediately to use free thick

split skin grafts and the main preparation was a saline bath in which the patient remained 3 to 6 hours a day, the same procedure being used as has been described for burned patients (1, 2). It is possible that this treatment was even life-saving for, when first seen, there was no conjecture as to how bad the infection might become. This simple procedure plus the daily use of soap and water and painting the raw surface with mild antiseptics was the complete preparation up to the time of operation.¹

Operation. The surface granulation and deep scar tissue is carefully dissected away in layers until the penis can be completely elongated, extreme care being used not to enter either corpora cavernosum or urethra. This procedure should be most painstaking, as complete relaxation of the scar and the necessity of obtaining a suitable surface for the graft are of first importance.

The next most important step is to obtain a free thick split skin graft of about one half to three fourths the thickness of the skin of the thigh, in one piece large enough to cover the penis completely without the necessity of patching any place (Fig. 3).

A catheter is inserted and one assistant holds the penis completely extended on the catheter. The graft is wrapped carefully and smoothly around the penis, the edges being overlapped to assure complete coverage. It is then sewed accurately in place all around the penis, at the corona and at the abdomen, and then down the line of overlap of the edges, with fine horsehair on fine needles. Further sutures are put through the surface of the graft with very shallow catches in the penis so that it is firmly anchored and matted in place. Multiple stab holes are put through the graft and all blood is expressed.

Fine mesh gauze is wrapped smoothly around the extended penis, and then a gauze flat is wrapped securely on with a sterile bandage so that the penis is held in complete extension on the catheter. An irrigation tube is placed alongside the penis, moist gauze sponges are carefully built up from all sides around the penis, and a manne sponge pressure dressing is applied by means of a double spica of gauze rolls. The whole dressing is firmly fixed to prevent any slipping or twisting.

From the Department of Surgery, Washington University School of Medicine.

¹The success in both of these patients was due in a large part to the work of Dr. Norman H. H., assistant resident surgeon at Barnes Hospital.



Fig 1 Complete restoration of skin of penis with free thick split skin grafts in one operation. Sensation and function normal. Shows also donor site on leg.



Fig 2 Complete restoration of skin of penis with free thick split skin graft in one operation. Sensation and function normal. A small amount of redundant skin was removed at a second operation.

The tip of the glans is left exposed to be sure of circulation, and the extended penis is now in somewhat of a cast with the catheter left in place at right angle to the abdomen.

If it is thought that a wet dressing is not necessary, the first gauze against the graft can be of 5 per cent xeroform, or some other ointment, and the irrigation omitted.

After-care The dressing is kept moist with saline, added through the irrigation tube, and is carefully taken off after 4 or 5 days. All sutures are removed, dead edges are trimmed away, and any blisters or infected areas are opened. Silver nitrate, 1 per cent, or some mild mercurial antiseptic, may be used locally and a firm grease gauze dressing carefully reapplied in an attempt to keep



Fig 3 Photomicrographs of thick split skin grafts which were used in patients in Figures 1 and 2. The grafts are about two thirds of the full thickness of the skin.

the penis still extended for a few days. If there is much cellulitis present a wet dressing should be maintained.

Later, if sebaceous collections occur in the graft, they should be emptied out by pressure or through slight incisions. If too much contracture either circumferentially or longitudinally should occur, more skin could be put in by simple incision of the graft, the edges being expanded and the defect filled with a scrotal flap or free skin graft.



Fig 4 Healed granulo ma inguinale with penis completely buried in scrotum but intact except for complete loss of skin. Restoration of skin covering with scrotal flaps and supplemental thick split skin grafts for the base of the penis and the scrotum.

SUMMARIES OF CASES

The patient shown in Figure 4 was seen after an extensive granulo ma inguinale had healed, with the penis completely buried in the scrotum. Urine came through 7 small fistulas, and, according to the patient's observation of the ulcerative and healing process, it seemed certain that the penis was actually present, and added to this, was the patient's assurance that normal erections occurred. At operation a penis of very large size was found in its scrotal bed with no sign of any skin covering whatever, but with the covering of the glans intact. The penis was brought out of the scrotum, and there was left attached a large scrotal flap that was wrapped around and united



Fig 5 Shows use of scrotal flap for partial restoration. The penis has been dissected free from a contracture into the right inguinal region, and the flap has been rotated up from the scrotum to fill the defect. The original lesion was a gunshot wound.

on the ventral surface. At a second operation, two more lateral scrotal flaps were rotated into the base of the penis after it was freed. This left the penis out of the scrotum but shortened and pulled in close to the abdomen with the scrotum elevated. Then, at a third operation, the whole contracted area was opened so that the penis could be completely extended, and the resultant raw area was covered with a thick split skin graft 11 by 22 centimeters. The patient left the hospital in excellent condition and apparently satisfied but would never return for examination or photograph.

Another patient¹ was seen with active ulcers of granuloma inguinale, which had failed to heal under medical and x-ray treatment. The ulcers were destroyed with the cautery over wide areas, and, after granulations had formed, the repair was done with free thick split grafts. Two stages were necessary because large areas had to be grafted in the inguinal regions and because one of the ulcers was so close to the urethra that it was

¹This patient was taken care of by Dr. George K. Lewis.

not grafted at the first stage. This patient finally became entirely healed but subsequently presented the same disease about the lips (3).

CONCLUSION

When the skin of the penis has been lost, it is thought that free thick split grafts may suffice in most instances for a suitable repair, and they might be used to effect early healing in ulcerated cases, even if a thicker pedicle flap repair might have to be done at a later date.

REFERENCES

1. BROWN, J. B., and BLAIR, V. P. The repair of defects resulting from full thickness loss of skin from burns. *Surg., Gynec. & Obst.*, 1935, 60: 379-389.
2. BROWN, J. B., BLAIR, V. P., and BYARS, L. T. The repair of surface defects, from burns and other causes, with thick split skin grafts. *Southern M. J.*, 1935, 28: 408-415.
3. BROWN, J. B., and MUCKENFUS, R. Granuloma inguinale with report of a case with oral involvement. *Internat. J. Orthodont., Oral Surg., & Radiography* 1932, 18: 988-992.

SPINDLE CELL BLADDER SARCOMA

EDWARD WILLIAM WHITE, M D F A C S , and REUBEN B GAINES, M D , Chicago, Illinois

PROBABLY 90 to 95 per cent of tumors of the urinary bladder are of epithelial origin. Primary sarcoma of the bladder, estimated to comprise about 4 to 5 per cent of the malignant tumors of this viscus is of great interest on account of its comparative rarity. Secondary metastatic sarcoma is extremely rare and less than 10 such cases have been reported in the literature. But the rarest and most interesting tumors of the bladder are those of mixed structure which show histologically cells of both epithelial and connective tissue origin. Only a very few of such tumors of the bladder have been reported in medical statistics. The following case of this type has been recently observed.

CASE REPORT

Patient S C age 38 years married was referred to the Alevan Brothers Hospital Chicago section of urology November 7 1936. He gave a history of trauma resulting from a fall 5 months prior to his entrance in the hospital. He claimed to have fallen from a truck a distance of about 4 feet and struck the pavement on his right side. Following the foregoing he complained of right renal pain and transient hematuria. A loss in weight of 10 pounds was reported during the past 5 months and the following urinary symptoms in increasing proportions namely dysuria nocturia urgency hematuria and marked suprapubic discomfort.

The patient was visibly cachectic anemic and presented a greatly distended bladder. Cystoscopic attempts resulted in failure due to excessive hemorrhage clots and villus like tumor processes which were in abundance in the bladder washings. Excretory pyelography presented a complete absence of right renal or ureteral shadows whereas the left kidney and ureter were within normal limits.

Suprapubic cystotomy was performed. A large fragile mass of tumor tissue was found to fill the bladder completely. The mass was gray pink in hue necrotic and bleeding profusely. The base was broad firm and not unlike cartilage in consistency. The cauliflower like necrotic tumor masses were removed by forceps and a firm wide cartilaginous base was thoroughly fulgurated including a wide area of apparent normal bladder mucosa. The base of the tumor was approximately 8 centimeters in diameter and included the right ureteral orifice which was completely occluded. The inevitable suprapubic fistula was established patient submitted to routine irradiation.

On January 11 1937 about 2 months following his entrance in the hospital a large area of necrotic hemorrhagic tumor tissue appeared at the suprapubic opening and on examination the bladder was again partially filled with recurrence of the tumor which was thoroughly removed and a second fulguration was performed. The patient is rapidly losing ground and a fatal termination is expected by metastases exhaustion or embolism.

Microscopic report. Section 1. Imbedded with loose fibrillar and moderately vascular connective tissue there

are fairly well circumscribed islands of long spindle shaped cells which arrange themselves in the form of interlacing bundles. The nuclei of these cells are oval moderately rich in chromatin and mitotic figures are frequently found. In the center of some of these islands one finds groups of irregularly shaped cells with ample clear cytoplasm. There are single islands in which the latter variety of pleomorphic cells predominate and in which there is a more marked variety in size shape and structures of the nuclei (Figs. 1 and 2).

Section 2 consists of a very vascular hemorrhagic and partially necrotic tissue which encloses islands of large polygonal cells with distinct outlines and oval nuclei rich in chromatin. There is a moderate number of mitoses with irregular short and plump chromosomes (Figs. 3 and 4).

Other sections revealed a diffuse overgrowth of pleomorphic cells. In places the cells formed cords and were polygonal or elongated with ill defined cell outlines. In other places the cells were elongated to spindle shape and separated by thin strands of a finely fibrillar tissue. In other areas mitotic figures were numerous.

Diagnosis. Transitional cell sarcoma with sarcoma like areas. The first section suggests a diagnosis of spindle cell sarcoma while the second section shows a squamous cell carcinoma. In another section transition between the two extremes is found and it can be clearly seen that by becoming elongated and arranging themselves in fascicles the carcinoma cells assume a sarcomatous appearance.

Sarcoma of the urinary bladder is indeed a rare entity. The first case histologically verified as a spindle cell sarcoma is ascribed to Senftleben in 1801. Gabe states that Guersant reported a case in 1853 unfortunately, no mention is made of histological proof. Wilder in 1905 searched the literature and reported 50 cases of sarcoma of the bladder with reasonable histological verification of the diagnosis. Of these, 21 cases were of large or small round cell type and 5 cases were mixed cell type (spindle and round cells).

Scholl in 1922 found only 1 sarcoma in 262 bladder tumors seen at Mayo Clinic. Munves in 1910 collected 107 cases in the literature and reported a personal case. In 1929 McCarthy and associates increased the total to 128 cases and since then one or two isolated cases have appeared in medical publications each year, so that less than 150 cases have been recorded to date.

All histological types have been reported—spindle cell round cell, mixed cell, alveolar angiosarcoma, fibrosarcoma, myosarcoma and myxosarcoma lymphosarcoma, and osteochondrosarcoma. Dr. Jaffe in his report of the pathological sections stated that these tumors are always questionable, difficult of differentiation, and have been recently noted in thyroid malignancies.

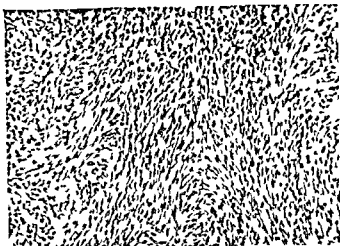


Fig 1

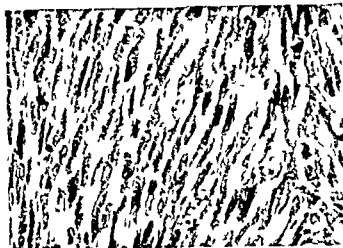


Fig 2

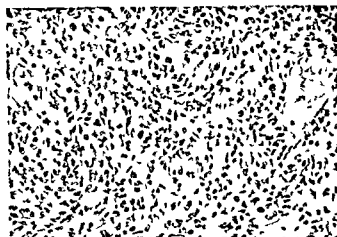


Fig 3



Fig 4

Fig 1 Spindle cell sarcoma like section an example of tissue in which imbedded with loose fibrillary and moderately vascular connective tissue, there are fairly well circumscribed islands of long spindle shaped cells which arrange themselves in the form of interlacing bundles

Fig 2 High power of Figure 1

Fig 3 A second section illustrating the transitional cell carcinoma. Large polygonal cells with distinct outlines and oval nuclei rich in chromatin are evident

Fig 4 High power of Figure 3

The question of the possibility of the occurrence of epithelioid sarcomatous tumors has passed beyond the stage of speculation, they are observed in the uterus, breast, testis, thyroid, and in certain other glandular structures, also other regions of the body where both types of tissue cells may be present, either as part of normal structures or as embryonal rest cells. In the urinary bladder, such a mixed cell tumor is obviously unusual. The preliminary pathological section made in the case before us was clearly a spindle cell sarcoma and as such was diagnosed by one of our most distinguished pathologists. However, after further pathological study and serial section analysis, the fact was firmly established that we were dealing with a questionable type which resulted in a diagnosis of spindle cell epidermoid sarcoma.

In the literature cases of epithelioid sarcoma of the urinary bladder have been reported by Kraft,

Krompecher, Lenormant, Borst, Parmenter, and Gabe.

Gussenbauer and Billroth reported myosarcoma and Albarran an adenosarcoma. In the 2 cases the tumors were probably derived from allantoic remnants at the bladder dome. Kraft's case was in a man 78 years of age. A small tumor was removed from the bladder wall by the intraperitoneal route, rapid recurrence followed which resulted in a mass the size of a fetal head. Upon histological examination the presence of epithelial and sarcomatous elements was demonstrated.

Lenormant reported an epithelioid sarcoma of the bladder probably of allantoic origin. Histologically it showed in parts a sarcoma with fusiform cells and in other areas epithelioid or alveolar tubules with cylindrical cells. The tumor was found in a woman 58 years of age and weighed 570 grams. In commenting upon Krompecher's case

and his own, Borst postulated the following possibilities

1 That a sarcoma and carcinoma may arise independently in the same area and ultimately fuse

2 That the mixed tumor begins as a carcinomatous epithelial growth and the stroma at the same time becomes sarcomatous

3 That a carcinoma develops in which the stroma gradually becomes sarcomatous

4 That rarely the tumor is at first a sarcoma and later the overlying epithelial structures become carcinomatous

Parmenter's patient was a 64 year old female. In this case various microscopic sections of the bladder tumor showed large spindle cells and irregular masses of stratified squamous epithelium with cell rests. In Gabe's case the pathological report stated that the tumor mass suggested a polymorphous cell sarcoma. Parts consisted of trabeculae of spindle cells and other parts contained solid trabeculae of polygonal carcinoma cells; however, the growth could be accepted as a mixed carcinoma and sarcoma. From the available evidence it was difficult to decide whether the tumor was primarily a carcinoma undergoing sarcomatous degeneration, whether a carcinoma and sarcoma had arisen simultaneously or whether the growth was carcinoma undergoing a typical degeneration. The spindle cells and the giant cells being the expression of a defense reaction to the carcinoma cells. The irregularity of the nuclei of the spindle cells, the presence of mitoses, and the absence of well formed blood vessels were in favor of a malignant growth.

McCarthy calls our attention to the fact that in a sarcoma of the bladder extending submucosally, a reaction proliferation of the overlying epithelium may augment ultimate ulceration. In one of their cases the microscopic section from the periphery of the bladder wall tissue adjacent to the tumor, presented at the edges transitional epithelium toward the center, the surfaces became denuded of epithelium and the underlying stroma was formed by an arrangement of spindle cells with long spindle shaped nuclei.

PATHOGENESIS

The question now arises as to the pathogenesis of these mystifying tumors.

Ewing cites Borst and others to the effect that sarcoma does not develop from previously normal cells, but from embryonal cell groups. He considered that the association of carcinoma with sarcoma is teratological in origin. In several cases

that he has noted, he was not satisfied that the spindle cell areas were not modified epithelium. This would be in accordance with Caulk's views, who states that there is a great selectivity of sarcomatous tumors of the bladder for the trigone and at its juncture base, which in all probability has a great deal to do with the faulty seam of fusion of the two fetal surfaces and the mesodermal origin of the trigone which is derived from the lower end of the Wolffian duct, the remainder of the bladder being derived from the ectodermal cloaca. In our opinion, however, it may be possible and quite logical that aberrant mesodermal embryonal cells may be located anywhere in the bladder wall, just as aberrant embryonal cells are found in various locations of the body.

For the foregoing reasons, if we may venture an opinion on pathogenesis, we personally prefer the fourth postulate of Borst, namely, that in a case of supposed epithelioma sarcoma of the bladder for example, the tumor is originally a sarcoma with the overlying epithelium undergoing carcinomatous change.

TREATMENT

The rationale of tumor management has traditionally been a perplexing problem confronting urological surgeons, and although there has been much divergence of opinion in the past, yet a review of the literature will impress one with the modern unanimity of thought and reaction on this subject. We must ever be mindful of the value of prompt diagnosis and early attack on bladder malignancies. Also the gradation, as learned from biopsy reports, will materially assist one in selecting the form of therapy to use in a given case. Roentgen ray, fulguration, radium and total cystectomy are our most potent weapons in the treatment of bladder tumor. Cutaneous ureterostomy, intestinal ureterostomy, and resections of the bladder vault or lateral walls have been discontinued in our service, and, in many instances, patients are made infinitely more comfortable and life has thereby been prolonged. Cutaneous ureterostomy in conjunction with fulguration and radium has been of inestimable value in selected cases.

The literature states that in 69 patients operated upon, only 3 patients were considered cured, having been followed for a period of from 3 to 12 years.

Liberal resection of the tumor bearing bladder wall or complete cystectomy and ureteral transplantation may result in cure in an early diagnosed case. However only about 8 such cases have been recorded in medical literature.

SUMMARY

In the foregoing case report, literary review, and pathological comments on the subject of spindle cell sarcoma, we are confronted with the question as to whether all the reported cases of spindle cell bladder tumor were true to type, also is it not logical to assume in the light of modern pathological investigation and the splendid work of The American Urological Society Tumor Registry that certain cases reported in the past might have been transitional?

Bladder tumors, not unlike malignancies in other bodily structures, continue to present an open challenge to surgeons and pathologists. The histogenesis, pathogenesis, and embryological uncertainties are gradually assuming more stable and dependable positions.

The epic making work of cancer surveys, cancer clinics, and pathological investigations are rapidly clarifying these perplexing problems, and we feel that in the not too distant future, tumor management will be greatly simplified.

The authors wish to express their due appreciation to Dr Richard Jaffe, Dr L. Hektoen, Dr J. P. Simonds, and Dr B. H. Neiman for their interest, enthusiasm, and courteous assistance.

REFERENCES

- 1 ALBARRAN, J. Les tumeurs de la vessie. Paris, 1892, p. 494.
- 2 BORST "Echte Geschwuelste" In Aschoff's Path Anat., 1923, 1: 76.
- 3 CAULK, J. R. J. Urol. 1926, 16: 211.
- 4 EWING, J. Neoplastic Diseases 3d ed pp. 265, 538. 541 Philadelphia W. B. Saunders Co., 1928.
- 5 GABE, J. A case of sarco carcinoma of the urinary bladder. Brit. J. Urol., 1932, 4: 145.
- 6 GARVEY, F. K., and BARRY, T. R. Spindle cell sarcoma of the bladder. Southern M. J., 1932, 25: 864.
- 7 GAZZOLI, J. Sarcoma fuso celular de vejiga operado por diatermia-coagulacion. Curacion. Rev. Med. Lat. Am., 1932, 17: 1713.
- 8 KRAFT. Ein Fall von Sarkomcarcinom der Harnblase. Ztschr. f. urol. Chir., 1921, 7: 12.
- 9 KROMPECHER. Cited by Borst.
- 10 LENORMANT. Bull. et mém. Soc. de Chir. de Par., 1922, 48: 1044, J. d'Urol., 1922, 14: 273.
- 11 MCCARTHY, J. I., STEPITA, C. T., and HALPERIN, S. J. Sarcoma of the bladder. Am. J. Surg., 1929, 7: 229.
- 12 MUNWES. Ztschr. f. Urol., 1910, 4: 837.
- 13 PARMENTER, E. J. Carcino sarcoma of the urinary bladder. Bull. Buffalo Gen. Hosp., 1927, 5: 19.
- 14 POZNANSKI. Cited by Gabe.
- 15 SCHOLL, A. J. Surg., Gynec. & Obst., 1922, 34: 189.
- 16 SEFTLEBEN. Cited by Wilder.
- 17 SMITH, L. D. Sarcoma of the bladder. Illinois M. J., 1930, 58: 103.
- 18 WILDER, J. A. Primary sarcoma of the bladder. Am. J. M. Sc., 1905, 129: 63.

CARCINOMA OF THE BREAST

HUGH H. TROUT, M.D., F.A.C.S., Roanoke, Virginia

TO speculate concerning the unknown is usually an entertaining but profitless pastime. However, if one studies the conditions that seem to precede the development of a disease of unknown origin, there is always the possibility that some knowledge might be obtained which might prove to be of prophylactic value. With this thought in mind we have reviewed the histories of 518 cases of carcinoma of the breast. This series of cases extends over a 25 year period. These histories were all taken by internes and many are incomplete but in none of them was there any attempt made to "fit the history" to any theory of etiology. Apart from everything else, we do not champion any theory as to the causation of carcinoma of the breast. However, this review is simply a statement concerning certain conditions of the breast which were found to exist before the diagnosis of carcinoma of the breast was made. Whether the correction of these conditions will prove of prophylactic value, time alone will determine, but, certainly the measures advocated to correct or prevent such a set of symptoms will at least be of benefit to the patient whether they have any value in preventing the development of carcinoma or not.

Some form of 'dysfunction' of the breast was found in 88 per cent of these 518 histories. This statement demands a fuller explanation of the expression of 'dysfunction'. For example (a) in 48 per cent the normal breast function was never established (b) in 38 per cent there was a distinct irregularity of lactation (c) in 10 per cent there were histories of abscesses definite and repeated trauma or infected nipples (d) in 12 per cent nothing abnormal was found in the histories.

In studying groups a, b, and c it might be interesting to review briefly some of the comparatively recent research work done concerning etiology of carcinoma of the breast. It might also be profitable to analyze as far as possible, what occurs in the breasts of the lower animals when subjected to certain hazards which are forced on women by the so called higher civilization.

Many attempts have been made to isolate some specific bacterial organism which might cause cancer. The consensus at the present time is that

cancer is not caused by any specific micro-organism.

Herring has recently published statistics to show that the incidence of carcinoma of the breast is 74.7 per hundred thousand in single women over 35 years of age, while with married women over 35 years of age, such an incidence is 41.9 per hundred thousand of population. In other words, the ratio of incidence in this age group is nearly twice as high in single women as it is in married women. In the ages below 35 years, cancer of the breast occurs so infrequently in both the single and married groups as to produce rates too low for accurate comparison. This bare fact is especially interesting at this time when so much is being published concerning the association of breast conditions and the organs of internal secretion.

Time does not permit me to discuss the various fascinating pieces of research work that have been done.

In the 246 cases in which lactation was never established, pain was found associated in the breasts a few days before each menstruation in 192, or 78 per cent. Of those 192 cases, 174 stated that the pain was most marked and the breast more definitely swollen on the side in which the carcinoma later developed. However, this information cannot be accurately estimated, for the patient naturally assumes the pain was more marked on the side in which the growth later developed.

The chemical theory of etiology of carcinoma began with the experimental work of Yamagawa who was able to produce cancer of the ears of rabbits by repeated application of ordinary coal tar.

Block and Dreypuss found that, by distilling coal tar at very high temperature, they obtained a product which produced cancer in mice in a shorter period, and in a higher percentage of cases than did ordinary coal tar.

Kenney isolated dibenzanthracene from coal tar and found such to be the carcinogenic agent. He further proved that, when this chemical was removed from coal tar, the coal tar did not produce cancer in mice no matter how frequently and how long it was applied. He also succeeded in producing dibenzanthracene synthetically and such was also highly carcinogenic in mice.

Recently Lacassagne has produced cancer in

male mice by the injection of estrin. This requires many injections, over long periods of time. The most frequent site of the cancer in these mice is in the breast.

Even more recently assays of breast tumors have been made, and such seem to indicate the existence of a carcinogenic hormone. These experimental indications combined with the clinical observations seem to indicate that the ovaries contain some carcinogenic control of breast tumors.

While neither the experimental results nor the clinical associations are sufficiently definite to be certain of dependence of the formation of breast tumors on ovarian dysfunction, still these studies emphasize the importance of the proper correction of pelvic disorders with the view of preventing tumor formations in the breast.

Max Cutler advocated the giving of ovarian residue (without corpus luteum) in these cases with painful breast, and with a few of our cases, we thought the patients obtained some relief from such medication. At the present time, we rather agree with Emil Novak in not having any faith in the oral administration of glandular extracts. Also our experience with the subcutaneous injections of estrogenic substance as advocated by Whitehouse has not been such as to inspire much confidence.

While much valuable research has been done in the physiology, pathology, and chemistry of the organs of internal secretion, and especially recently concerning the interdependence of the various glands on each other, still at the present time we do not seem to have any definite therapy to relieve these breasts which are painful during and preceding menstruation, and which might be the forerunners of the future cancer.

However, we have found that the pain in many of these cases is relieved by the use of a properly fitting brassiere. This pain is frequently most pronounced in the upper outer quadrant of the breast. A "pocket" brassiere with a piece of elastic about 4 to 6 inches long in the strap support, with the straps crossed behind the shoulders and with an adjuster in front where it is accessible, prevents the drag of the breast. Experience has taught us that different types of brassieres will be needed to elevate and support different types of breasts, the essential factor being that the breasts are not pulled to the chest wall as is now usually done.

As cancer of the breast is also found most frequently in the upper outer quadrant, it makes one give more serious consideration to the lymphatic obstructive theory of Handley as being a possible etiological factor. In this connection, it is interesting to recall the fact that malignancy of the

udder of the milk cow is practically unknown. With the dairy cow, lactation is almost continuous, and the dependent position of the teats allows free and complete drainage. Drabble made a very extensive study of the udders of all cows slaughtered in the State abattoir at Homebush Bay, New South Wales, Australia, from 1926 to 1929. He does not state how many animals were killed during that period, but he was able to find only 3 cases of malignancy of the udder and all 3 of these were epitheliomas and did not involve the milk ducts.

Feldman, in his book entitled *Neoplasms of Domesticated Animals*, states he has never seen a case of carcinoma of the udder of a milk cow.

Cancer of the breast of bitches is very frequent and is perhaps due to the fact that the puppies are removed from the breast very early, probably before the mother finishes the lactation period.

Bagg was able to produce 87 per cent of mammary carcinoma in mice by removing the young from their mothers soon after birth. The incidence of mammary carcinoma in the control group was less than 5 per cent.

Cancer of the breast in Japanese women living in Hawaii, who have a large number of children, is very rare. The same condition of affairs exists in the miners' wives in West Virginia. This may be due to the fact that these women have the idea that while nursing a baby there is little danger of pregnancy, and that they continue lactation as a defensive measure.

All these factors would seem to indicate that those conditions which do produce obstruction or irritation (lymphatic or any other type) might produce cancer, especially in those patients with "constitutional tendency" to malignancy. What biologists mean by the term "constitutional tendency" is necessarily somewhat indefinite. However, there is no doubt that there is a definite association between heredity and cancer. Articles by Little and others working with high and low cancer strains of mice definitely demonstrate such an association with animals, while the study of Clara J. Lynch with twins and cancer in the human race proves without a doubt that heredity does play a very definite role in the causation of cancer in the human being. The following is a very clear statement quoted from a small portion of her article:

Of special interest for this discussion is the testimony from duplicate twins. If two individuals are derived from the splitting of one fertilized egg and therefore composed of the same germ plasma, they should not only resemble each other to a marked degree in physical appearance, but should also exhibit the same susceptibility to disease, if it is true that susceptibility is an inherited character. In

TABLE I—MODIFICATIONS

Name of Patient	Age	Date
40 or under	= 10	
41 to 50	= 4	
55 or over	= 2	
Lactation		
History of no lactation and no pain in breasts associated with menses	= 0	
History of no lactation but pain in breast associated with menses	= 6	
History of lactation and no pain in breast associated with menses	= 0	
History of lactation and pain in breast associated with menses	= 3	
Irregularities of lactation	= 6	
Breast lactating at time of examination	= 15	
Rate of growth		
Slow (over 24 months)	= 4	
Moderate (12 to 18 months)	= 8	
Rapid (under 3 months)	= 16	
Size of tumor		
Small (3 cm. or less)	= 5	
Large (over 3 cm.)	= 10	
Ulcerated	= 30	
Malignant glands		
Numerous small axillary	= 12	
One large in axilla	= 6	
Under triangular ligament	= 60	
Supra-clavicular	= 60	
C I M Total	=	
Grade A (relatively benign) C I M	= 11 to 35	
Grade B (moderately malignant) C I M	= 36 to 49	
Grade C (highly malignant) C I M	= 50 and over	
	M D	
C I M Clinical index of malignancy		

recent reviews of the literature 38 cases have been discussed. In 1 case only 1 member of the pair had a tumor. But as the unaffected individual in all but one instance was still living when last investigated the final report for this group cannot be given. Since some variation is to be expected the occurrence of a limited number of exceptions will not detract from the extraordinary picture afforded by the 26 remaining pairs. All had tumors the growths of each couple were in general of the same type in the same organ and appeared at approximately the same time. The fact that when both twins do have tumors they present such conspicuous similitudes is of a great importance. The parallel in their case histories speaks strongly in favor of genetic control.

While the work done on the association of heredity and cancer is most interesting, still I am quite sure we will not be able to establish any prophylactic measures until we give as much thought to the mating of human beings as cattlemen do to the breeding of their animals. Certainly were we able properly to mate human beings in a bio-

logical sense, such as Maud Slye has done with mice, we have every reason to believe we could "breed out" carcinoma of the breast in the human race.

We have all had experiences with cancer of the breast in pregnancy, and doubtless recall how very "wild" the malignancy developed. In 1922 I was able to collect (12), as a result of a questionnaire only 15 instances in which pregnancy was known to have occurred after removal of a breast for carcinoma. Of this number, 13, practically 87 per cent, developed carcinoma in the remaining breast, 12 of whom died very promptly. The interval period between operation and recurrences associated with pregnancy varied from 2 to 10 years.

If these observations are accurate the following practical suggestions might prevent the development of precancerous conditions of the breasts.

1 More careful history taking with an accurate analysis of the history. Deductions made from these histories will often also aid in determining whether to treat the case as benign or whether to handle it as a possible precancerous lesion.

2 Education of mothers as to the necessity of nursing their babies for at least 6 months or until the breast has been relieved of all products of lactation and stagnation.

3 If for any real reason the mothers are not able to nurse their babies, insistence on the use of a breast pump (preferably an electrical one) until the breasts have been drained of all signs of retention of any of the products of lactation.

4 More careful attention to the care of the nipples.

5 Correction of pelvic disorders especially when there is any pain in either breast during the menstrual periods.

6 More consideration to the proper support of the breast at all times.

7 Instruction of young mothers not to become pregnant again after having had an operation for cancer of the breast.

In visiting various hospitals I have been much impressed with the difference in the attitude of the pathologists and the surgeons as regards the prognostic value of the histological study of tissue. Many pathologists apparently feel that there are too many uncertain and uncontrollable factors entering into such a study to give as much weight to its prognostic worth as do most surgeons. Some of these factors are:

1 The individual equation of the various pathologists in differentiating cells. This was demonstrated by Bloodgood who sent the same set of slides to a number of well known patholo-

TROUT CARCINOMA OF THE BREAST

gists and received in reply many different estimates of the same tissue

2 The site from which the specimen is removed, for certainly the histological picture changes the farther from the active cancer the specimen has been taken

3 The uncertain response of cancer cells to irradiation. Frequently it looks as if the more active and immature cancer cells regress more quickly than do the more stable and mature cancer cells when exposed to proper irradiation

In 1928 Lee and Stubenbord published a clinical index of malignancy for carcinoma of the breast, and since this time we have been using a modification of it and found it of great value. Lee and Stubenbord followed for 5 years 100 cases of carcinoma of the breast which had been classified by their clinical index, and Ewing made groups of grades based on the histological index of the same 100 cases. The clinical grading was found to be more reliable than grading by the microscope. However, we continue to employ the histological "grading" of pathological specimens and feel both methods should be used jointly. In Table I are shown the modifications

Carcinoma of the breast does not differ from any other disease in the fact that every case should be studied as an individual case and be given the benefit of such an analysis. However, there are certain general principles around which all treatment revolves. To be more specific, we feel that surgery, with the addition of intelligently given irradiation, is the basis of the proper treatment of carcinoma of the breast.

Routine x-ray examinations of the chest, pelvis, and long bones are made in all cases of carcinoma of the breast. During the last 100 cases we have found metastases in 2 cases in which there was no pain and nothing else to suggest the existence of such a condition. There were 3 other additional cases in this same series of 100 cases in which pain (usually thought to be "rheumatic") indicated that metastases might be found on x-ray examination, and such were demonstrated to be present.

Pre operative irradiation is probably the most important contribution of radiologists to the treatment of cancer of the breast and is now generally regarded as being of even more importance than postoperative treatment.

There is one great danger in giving pre-operative irradiation that is not usually mentioned when the treatment of cancer of the breast is considered. With many of these cases, there is so much improvement in 4 to 6 weeks after exposure to the x-ray that the patients do not come back

to the hospital for the necessary surgery until growth has begun to increase again. This situation is somewhat comparable to that existing in the case of hyperthyroidism and the preparation with iodine of the patient for a safer parathyroidectomy. For some reason, we do not seem to be able to exercise this proper control of many of our patients. As a result of this, we try to make an accurate estimate of the patient's mental ability and willingness to co-operate. There is any question in our minds that the patient is mentally unable or unwilling for any other reason to carry out directions intelligently, that we advise immediate operation without pre-operative irradiation. The present tendency toward the more frequent employment of extensive pre-operative irradiation by the Coulter method with a high voltage machine.

Occasionally, in very bad surgical risks in extremely old patients, we do only an amputation of the breast and give both pre-operative and postoperative irradiation. However, such a practice is very rarely justifiable.

We feel very strongly that a radical removal of the entire breast, the muscles, axillary contents, etc., should be done in one dissection, from periphery toward the center, in other words, complete Halsted type of operation. We employ an extra fine silk for the ties, and with such ligatures only very small amounts of tissue, if any, besides the actual vessel wall, are tied. We wash out the entire operative field with hot saline solution hot enough for the hand to stand the heat, but not so hot as to burn the skin. This not only washes out any clots of blood that might be present, but, it is possible that the hot water kills any immature cancer cells which may have escaped into the field of operation. The heat has some hemostatic value as far as the extremely minute vessels are concerned, sometimes the minute vessels are the cause of postoperative collection of serum.

The skin incisions are made wide of the grooves and no thought is given to the closure of the wound at the time of making these incisions. It has been suggested that the surgeon who makes the incision for removal of a cancer of the breast should not be the one to close the field of operation, then he does not have the temptation to go a little closer to the malignancy in order to make closure of the operative field easier.

Thiersch grafts taken from the thigh are easily obtained and usually successful.

A small stab incision is made in the axillary line. Through the opening is placed a tube containing 50 milligrams of radium.

light weight rubber drain. The drain is placed between the axillary vessels and the radium. In addition to the radium which is placed in the axilla, another 50 milligrams of radium are distributed in the area supplied by the internal mammary vessels and lymphatics. Four 12½ milligram radium needles are placed in a rubber tube which is about 12 to 15 inches long. A string is tied around the rubber tube in between the needles of radium. In this manner, the radium is distributed equally throughout the length of the tube. This tube is then placed under the skin and the long end is brought out through the lower end of the incision, while the length of the tube occupies the area normally supplied by the lymphatics, which accompany the internal mammary vessels. We have never been able to detect how this radium in any way seems to interfere with the healing of the incision or the 'taking' and development of the skin grafts.

The skin over the chest and axilla is held firmly against the chest wall with the aid of a large sea sponge and is held in place by adhesive straps. The arm is left free and the patient is made to use it as soon as she is conscious.

Less than 1 per cent of our cases have had swollen arms which have given any serious trouble. We feel that the swelling of the arm when it occurs is due to a low grade infection in the axilla, preventing the regeneration of the lymphatics. This point was demonstrated beautifully in animals by Reichert.

Postoperative irradiation will produce slight bronzing of the skin. This is accentuated at the portions of the flap where radium has been implanted where there is frequently marked reddening with peeling.

Irradiation of the ovaries in young women to produce an artificial menopause should be done in every case in which the patient is still menstruating. Our attention was first called to this by Dr C. H. Peterson. He was giving irradiation to a pelvic metastases for the relief of pain in a case of carcinoma of the breast. After several weeks of treatment of the pelvis by irradiation the primary inoperable carcinoma of the breast decreased markedly in size. The patient died of carcinomatosis, but this experience made us think of the possible association between an ovarian hormone and malignancy of the breast.

A visit to the Memorial Hospital in New York will convince anyone of some relationship between the ovaries and cancer of the breast. There they have roentgenograms of 2 cases with what they thought were metastases in the lung. After irradiation of the pelvis the lung shadows disap-

peared. Of course, no one can be certain that the lung findings were metastatic malignancies.

Herrell, of the Mayo Clinic, studied the relative incidence of oophorectomy with and without carcinoma of the breast. He reviewed approximately 3500 cases. He found "the incidence of complete oophorectomy or castration was approximately ten times as great among the non-cancer bearing females as in the group of women who developed carcinoma of the breast after oophorectomy or castration." In other words cancer of the breast occurs ten times more frequently in the normal woman than it does in women who have had the ovaries removed.

Our experience with the irradiation of metastases has been briefly as follows. There has been no "cure" in any case. However, the pain of the metastases has been relieved in the vast majority of cases. We have no way to make an accurate estimate as regards the rate of growth of these metastases in comparison with those patients with metastases who have not had irradiation. However, such patients certainly are made more comfortable by the employment of irradiation even if the rate of growth is not slower.

We feel that irradiation combined with radical surgery is indicated in practically every case and base this opinion on a study of our results.

Up to 1920 the percentage of 5 year (or over) 'cures' was 22 per cent and during this period only radical surgery was employed.

From 1920 to 1924 radium was added to radical surgery, and in this group the percentage of 5 year (or over) 'cures' was 30 per cent.

From 1924 to date with the employment of pre-operative and postoperative x-ray treatment with a high voltage machine in addition to the radium and radical surgery, our percentage of 5 year (or over) 'cures' is 55 per cent.

These percentages include all the patients both operable and inoperable admitted to the Jefferson Hospital during this 25 year period.

By the term 'cure' we do not mean to imply that we ever consider any case of cancer of the breast as absolutely cured but, used the period of 5 years for comparison purposes.

Of course, cancer education has also been a big factor in this improvement of the percentage of so called 'cures,' but, it is impossible to estimate accurately this factor. However, I am certain we are still seeing far too many cases of well advanced carcinoma. In fact, the interval between the time when the patient first noticed the "lump" in the breast and the time she comes for operation has remained about the same—the average being about 6 months.

No one will deny that intelligently administered irradiation cures superficial malignancies, therefore, it is logical to assume that such irradiation should help to prevent recurrences after operations for carcinoma of the breast. In fact, there has been only one local recurrence following the last 117 operations. Before the employment of irradiation in association with surgery the percentage of local recurrences was slightly over 5 per cent. To my mind, this alone would justify the employment of intelligently administered irradiation in association with radical surgery.

BIBLIOGRAPHY

- 1 BAGG, H. J. Experimental studies in the etiology of mammary carcinoma. *Tr Ass Obst, Gynec & Abd Surg*, 1927, 40, 222.
- 2 CUTLER, MAX. The cause of "painful breasts" and the treatment by means of ovarian residue. *J Am M Ass*, 1931, 96, 1201.
- 3 DRABBLE, J. Cancer in the udder of cows. *J Comp Path & Therap*, 1929, 42, 40.
- 4 FELDMAN, W. H. *Neoplasms of Domesticated Animals*. Philadelphia and London W. B. Saunders Company, 1932.
- 5 HANDLEY, W. S. *The Genesis of Cancer*. London Kegan Paul, 1931.
- 6 HERRING, R. A. *Bull Am Soc Control of Cancer*, 1936, 18, No. 6.
- 7 IEF, B. J., and STUBENBORD, J. G. S. A clinical index of malignancy for carcinoma of the breast. *Surg, Gynec & Obst*, 1928, 47, 812.
- 8 LITTLE, C. C. The present status of our knowledge of heredity and cancer. *J Am M Ass*, 1936, 106, 2234.
- 9 LYNCH, CLARA J. *Bull Am Soc Control of Cancer*, 1935, 17, No. 2.
- 10 NOVAK, EMIL. The therapeutic use of estrogenic substances. Glandular physiology and therapy. *J Am M Ass*, 1935, 104, 1815.
- 11 REICHERT, F. L. The regeneration of the lymphatics. *Arch Surg*, 1926, 13, 871.
- 12 TROUT, H. H. The remaining breast after radical removal of the opposite side for carcinoma. *Surg, Gynec & Obst*, 1922, 34, 630-632.
- 13 WHITEHOUSE, H. B. A study of mastopathia and chronic mastitis. *Surg, Gynec & Obst*, 1934, 58, 278-286.

KELOIDS FOLLOWING LAPAROTOMY

JAMES C. WOOD, M.D., F.A.C.S., Cleveland, Ohio

THE simplest term in which a *keloid* may be defined is "a tumor-like fibrous outgrowth, usually occurring at the site of a scar" (Gould). It may occur in any part of the skin surface as the result of either accidental or surgical traumatism. We are concerned in this short essay only with its presence in laparotomy wounds where to the writer its occurrence seems unnecessarily frequent. The principles involved, of course, apply to incised wounds in any of the skin areas.

The normal healing of an incised wound is promoted by first cleanliness, second, the control of active bleeding, third, careful apposition, fourth, and by no means least, the prevention of undue wound tension until its tensile strength equals that of the surrounding tissues.

Absolute asepsis of the skin is an impossible achievement without tissue destruction. Indeed, so says Carrel, a few microbes are necessary to excite sufficient local reaction to inaugurate the healing process.¹

This process comprehends, after the foregoing dicta have been observed, first the gluing together of the adjacent surfaces by a thin layer of coagulum containing fibrin and red and white blood cells; second, the production of fibroblasts through mitosis of the connective tissue cells, third, the creation of a new blood supply through the formation of capillary buds, fourth, the intermingling of the fibroblasts of the opposing sides, creating collagen fibrils with resulting permanent union, and fifth, the final covering of the wound, if approximation is not perfect, with epithelial cells (Christopher).

If the healing is ideal, there will be noticeable only a linear, almost imperceptible scar—a white fine line containing ultimately an irreducible minimum of fibrous tissue. If the incision lies in the proper direction of the skin tension, there is less danger of the skin spreading than when it is made in an opposed direction. Unfortunately, a vertical incision in the mid abdomen in so far as the skin wound is concerned, does not conform to this requirement.

If the phase of fibroplasia, because of interfering factors, is developed beyond the requirements of normal healing, a keloid may develop. In the healing of wounds by second and third intention,

the formation of granulation tissue is necessary for epithelization. In keloids following burns the disfigurement is sometimes enormous, especially when located on or about the face.

Pathologically then, a keloid consists of a mass of cicatricial fibroconnective tissue, composed of coarse hyalinized collagen fibers without elastica (McFarland). It has no capsule and fades into the surrounding connective tissue. In whites, its color is pinkish red; in negroes, in whom it occurs oftener, somewhat darker than the surrounding skin. As time goes on it sometimes disappears spontaneously. Malignant degeneration is a possibility as in all adventitious growths where either prenatal or postnatal embryonic cells predominate, a theory especially stressed years ago by Conheim, and which has never been entirely disproved.

The abdomen is made up, from without inward, of skin, superficial and deep fascia, muscle, subperitoneal fascia, and peritoneum. In the exact midline separating the recti, no muscle tissue is exposed in making a vertical incision. But the several layers vary greatly in the time required for healing after coaptation. Thus the peritoneum, a serous membrane, heals very quickly and fortunately so, for should infection occur, the abdominal cavity is thereby protected. Muscle cells, on the other hand, take no part in the process of repair—only the muscle sheaths. Skin and mucous membranes heal quickly because epithelium has a marked power for regeneration (Christopher). It is a broad surgical principle in closing all wounds that, whenever possible like tissues should, in suturing, be made to assume their original relationship.

We have no cross section of our surgical records showing the frequency of abdominal wound infection or the frequency of keloids. Unfortunately, most hospitals during our surgical career kept no such records, and we are making no attempt to evaluate our statistics in their entirety. But our private records, covering several thousand cases, in each instance tell the exact method of wound closure, so that years later, when opportunity affords, one can make fairly reliable comparisons.

May we say, in passing that at the time of our graduation in medicine, Pasteur's epochal discovery and Lister's early observations, although made several years before that event, the germ

¹Man: The Unknown. By Alexis Carrel. p. 202

theory of disease was just beginning to be seriously discussed, and with no small degree of acrimony. Our records, therefore, cover more than 50 years of a fairly active abdominal surgeon who has experimented with many and various techniques in making and closing abdominal wounds.

Wound infections, cicatrices of all forms, and postoperative hernias are much less frequent now than formerly—thanks to the evolution of a more ideal technique. But keloids, it seems to the writer, still occur all too often. Because of the fact that, when present in an abdominal scar, they are less conspicuous than when present in exposed areas, their importance has been underestimated.

Our observations, then, lead us to the following conclusions:

- 1 A blood clot within a flesh wound, while at times serving a very useful purpose in the healing of fractures, often leads to wound infection.

- 2 Too great an effort to control all blood oozing by pressure clips frequently leads to tissue necrosis with resulting infection.

- 3 The overloading of the wound with catgut, especially when the body resistance is below par, because of age or otherwise, portends danger. The finest strands, compatible with safety, should be used and as few knots as possible left behind for nature to absorb.

- 4 Postoperative oozing can be prevented by reinforcing the opposing surfaces with tension sutures, preferably silkworm gut. These sutures also overcome, during the first few days of healing, all skin tension.

- 5 The bringing together, in closing the skin, of a wider area of raw surface than is afforded by edge-to-edge approximation only, is accomplished by means of Michel clamps. For years before these clamps were introduced, we attained the same objective by means of interrupted mattress sutures, introduced not less than 3 millimeters from the wound edges. This same principle, before the Watkins's technique was evolved, we utilized for a number of years in cystocele and prolapse operations.¹

- 6 Relieving the skin wound from all lateral tension, with butterfly adhesives, for at least 3 weeks after the patient leaves the hospital, we consider the most important step of the entire technique. It sums up the especial object of this brief thesis. Nature, wonderfully kind when not handicapped, cannot in the brief interval of 5 or 10 days complete her method of welding together

the skin edges so securely that they will remain in close contact indefinitely—hence the wide and unsightly scars which in time all too often develop. From the standpoint of artistry, it is not the immediate appearance of the wound that matters so much as its final appearance after 1 or 10 years have elapsed.

We began the practice of abdominal surgery when dependence was placed upon "through-and-through" interrupted silk sutures only. Those were the good old days of postoperative hernias and cicatrices. The sutures were left *in situ* for 10 days and after their removal, if the abdomen happened to "blow up" with gas, the wound separated allowing the intestines to escape. Later, silkworm gut, silver wire, and catgut displaced the inadequately prepared silk, and the results were better but far from perfect. For years we used the subcuticular skin stitch (silk, silver wire, silkworm, or catgut) with ideal immediate results, but with most discouraging mediate results. Wounds thus treated, when the dressings were first removed, won the admiration of one's students. But in the patients who have returned to us after several months or years, a larger percentage of keloids has followed in the train of the subcuticular stitch than when interrupted stitches alone were used. Why this is so we do not attempt to explain. Possibly the projecting suture ends favored the entrance of micro-organisms into the wound, or the suture, because of close proximity to the wound edges, interfered with nature's delicate mechanism of healing by first intention. We are especially emphasizing this fact for the reason that the subcuticular mattress suture in skin approximation is now quite commonly used and keloids are showing up with corresponding frequency. The surgeon should then, in closing the abdominal wound, keep in mind the fundamentals which we have attempted to summarize. The writer's sole object in reviewing them is to lessen the number of keloids which are still all too frequent. It is to be regretted that no known method of wound closure up to the present time is 100 per cent perfect. But a more thorough knowledge of nature's processes, encouraging rather than antagonizing them, will carry us far in the prevention of unsightly scars. At least this has been our experience.

TECHNIQUE AND SUMMARY

Our conclusions can best be epitomized by summarizing the procedure which we follow:

- 1 General or spinal anesthesia is used. Local

¹See the writer's contribution to Howard A. Kelly's *Stero-Clamp*, Section 23, on *Prolapse of the Uterus*, also A new operation for cystocele. *Am J Obst* 1905: 1: No. 2.

anesthesia, especially when used in excess, has a tendency to devitalize the tissues.¹

2 Careful asepsis is never, no matter how rigidly observed, 100 per cent perfect, therefore, the skin incision is made with scalpel number one. Scalpel number two is used to divide the underlying structures. All active bleeding is controlled but moderate oozing is ignored.

3 The operation completed, the peritoneum is brought together with a fine, plain gut suture.

4 Three to 5 silkworm tension sutures are introduced from within outward, the same needle never being used twice during the operation. Exit of the needles is at least 2 centimeters from the wound edges. The sutures should include, other than the layers of fascia and the recti, the ridge of tissue resulting from the closure of the peritoneum, so that, when they are finally tied, there will be no dead space between the peritoneum and the intervening fascia. These sutures are left untied until the skin clamps are applied.

5 The deep fascia, either edge to edge or overlapping, is carefully sutured with chromic gut No. 1 or 2, as few knots as possible being left.

6 The skin wound is closed with Michel clamps so placed as to make it possible to remove them with minimum trauma to the healing skin wound behind. Before the last one or two clamps are applied pressure is made from below upward with a gauze sponge for the purpose of expressing any accumulated blood or serum from the wound.

¹This the writer has stressed in his book *Uterus and Gynecology*, p. 211, being his statistical basis.

7 The interrupted sutures are tied over narrow strips of gauze, saturated in 95 per cent alcohol, placed on either side of the clamps, just tightly enough to control all oozing. Unless the clamps are thus protected, unnecessary suffering ensues, both from the tension sutures and from direct pressure upon the clamps when the outer dressings and binder are applied. The alcohol serves a most useful purpose as a destroyer of germs.

8 The tension sutures are removed not earlier than the fourth day and the clamps not earlier than the fifth day following the operation. After their removal, the skin wound is sustained for at least 3 weeks by the application of butterfly adhesives, the wound being protected by an underlying strip of sterile gauze. Adhesive plaster should never come in direct contact with the skin wound, even though its center is smeared with an antiseptic, for at least 10 days following the operation. It cannot be made absolutely sterile and, when so placed, frequently results in slight skin infection which is often the forerunner of a keloid.

This summary is deduced not, as we have emphasized, from accurate statistical data, which would be quite impossible to obtain from the case records of any consulting surgeon whose clientele is scattered far and wide, but rather from such cases as have subsequently returned to us for re-examination, or for newly developed symptoms. During the last 15 years, we have especially stressed for our internes the closing italicized paragraph with correspondingly better results.

EARLY WEIGHT BEARING IN FRACTURE DISLOCATION OF ANKLE JOINT

AARON H. TRYNNIN, M.D., Brooklyn, New York

THREE important objectives involved in the treatment of fracture dislocation of the ankle joint are (1) the fracture must be so reduced that complete anatomical position of the fragments be restored, (2) this reduction must be maintained throughout the period of healing, (3) the function of the extremity must be restored in the shortest possible time.

1 Reduction of the fracture Failure to obtain a complete anatomical reduction will result in arthritic changes about the ankle joint which will cause considerable disability in later life. Although a perfect reduction may not be necessary to obtain a good functional result in fractures about other joints, a perfect reduction is necessary in fractures about the ankle. Slight widening of the malleoli, or displacement of the astragalus, wherein the weight bearing is not distributed to the center of the lower articular surface of the tibia, will cause erosion of the adjacent articular cartilage, with varying degrees of arthritis and ankylosis.

More important than the malleolar fractures occurring about the ankle is the accompanying dislocation or subluxation. Trethowan stresses the point, in discussing this injury, that it is better to consider it primarily as a dislocation of the ankle joint than as fractures of the malleoli. The word "fractures," he states, clouds the issue by stressing the less important feature. He prefers the term "dislocation fracture" to the term "fracture-dislocation." The misplaced joint, not the broken bone, is the main cause of the discord and excessive friction in the working parts.

Accordingly, the reduction of this injury should be instituted as early as possible. The main objective is to reconstruct the joint so completely that weight bearing surfaces are in perfect apposition. In the majority of cases, whether the dislocation is lateral or posterior, partial or complete, such reduction can be easily accomplished, if performed immediately after the injury is sustained. On the other hand, the waiting of several days or hours may make such reduction impossible, and may necessitate open operation.

Local anesthesia should be used, and the reduc-

tion should be performed according to the method advocated by Boehler. About 20 cubic centimeters of 2 per cent novocain should be injected into the fractured portions of the tibia and fibula and into the ankle joint. The surgeon, seated on a low stool, supports the injured foot on his knee. Pressure is applied over both malleoli to disperse the effused blood. The flexed knee relaxes the pull of the gastrocnemius. Reduction is then accomplished, depending on whether the dislocation be lateral or posterior. The heel is held in the midline, the forefoot in mid position (not in supination).

Boehler emphasizes the fact that the foot should be placed at right angles to the leg, or in slight degree of plantar flexion. He cautions against dorsiflexing the foot, because the front part of the astragalus (which is wider than the back) is forced between the malleoli, and tends to separate them.

2 Maintenance of reduction With the methods commonly used, namely, the application of a circular plaster bandage over various thicknesses of sheet wadding, there is a tendency usually for the foot to become displaced. After the swelling subsides, a certain amount of laxity results. The foot is not held firmly fixed in the plaster, and the muscle pull that is permitted will often cause a displacement. Dickson, in discussing posterior marginal fractures of the tibia, applies a plaster cast extending above the knee, which is held in moderate flexion to avoid a possible recurrence of the posterior dislocation and displacement of the marginal fragment. After 2 weeks, the portion above the knee is removed. A number of surgeons advocate an open operation and fixation of the fragments with wires. Dieterle describes 2 cases in which he used wires, 1 with an open and the other with a closed reduction, and he advocates such method of procedure in marginal fractures.

In the type of cases presented, I have found these procedures to be unnecessary, provided one uses a properly applied non padded plaster such as advocated and described by Boehler. After the fracture is reduced, a plaster splint is placed directly over the skin on the lateral aspect of the leg and foot, in stirrup fashion. This is incorporated in a flannel bandage, and a second splint

From the Service of Dr. S. Kleinberg, Hospital for Joint Diseases.



Fig 1



Fig 2



Fig 3

Fig 1 Case 1 Posterior dislocation of the ankle with fractures of shaft of fibula lateral malleolus and posterior margin of the tibia

Fig 2 Immediately after reduction The ankle has been

immobilized in a well fitting non padded plaster

Fig 3 On removal of the plaster 10 weeks after injury Position of fragments maintained in spite of weight bearing Note absence of osteoporosis

is fixed over the posterior aspect of the leg and sole of the foot Two or three circular plaster bandages are applied Firm pressure is maintained over both malleoli while the plaster is hardening Without sheet wadding and with the plaster adhering to the hairs of the skin, no motion is permitted at the ankle The plaster should be used merely as a retentive bandage, never as a corrective one

If the reduction, as checked up by postoperative roentgenograms, is satisfactory, not only will this plaster hold the fragments in position but also early weight bearing may be permitted without fear of subsequent displacement of the fragments

3 Restoration of function The average duration of disability in those cases in which no weight bearing is allowed is about 6 months or longer Dickson in his article referred to, does not permit

weight bearing before 8 weeks Trethowan likewise cautions against weight bearing before 6-8 weeks The fear, of course, is that of displacement of the foot Without weight bearing atrophy of the muscles and osteoporosis of the bones of the leg and foot result The ankle becomes stiff Weight bearing is now a painful procedure and several weeks of active physiotherapy follow before the patient is able to bear weight without discomfort The patient uses his crutches only while the plaster is on, but also for many weeks after the plaster is removed Then weight bearing without support is a cautious tedious procedure until the muscles become active, the ankle joint mobilized, and the bones regain their normal texture

In the cases presented a walking iron is incorporated in the plaster and, after a few days the patient is permitted out of bed When



Fig 4



Fig 5



Fig 6

Fig 4 Case 2 Tri-malleolar fractures of the ankle with lateral dislocation of the foot

Fig 5 Complete reduction of the fractures and dislocation

A non padded plaster of Paris cast has been applied

Fig 6 After removal of the plaster 7 weeks later No callus, no displacement of fragments no osteoporosis



Fig 7, left Case 3 Posterior marginal fracture of the tibia with posterior dislocation of the astragalus

Fig 8 Nine weeks after reduction and early weight bearing Healing with maintenance of reduction

crutches are permitted, the patient learns to depend on the crutches for support and can be encouraged to discard them only with difficulty. When a cane is used, the majority of patients can learn to walk without any difficulty after a week. Many can get along even without the cane. The plaster is maintained for 8 to 10 weeks, depending on the severity of the injury. During this time, they are actively using their muscles. The circulation of the extremity is maintained, the swelling of the toes disappears quickly, bone atrophy from disuse cannot result. On removal of the plaster a fairly good range of motion at the ankle joint is found in most cases. The calf muscles of the affected leg are only slightly weaker than those of the other leg. Roentgenogram will show no osteoporosis, the patient can immediately bear weight on the foot without pain. Usually, 2 or 3 weeks of physiotherapy are required to mobilize the ankle joint completely. The average duration of disability is 10 to 12 weeks usually. To prevent the swelling that occurs after removal of the plaster, Boehler uses an Unna paste boot. I have found a flannel bandage (applied after the leg and foot have been well

painted with mastisol solution) or an elastoplast bandage to be just as effective. Massage and prolonged physiotherapy are not indicated when subsequent swelling is prevented.

CASE 1 Female aged 27 years, sustained an injury to the right ankle in April, 1933. She was 8 months pregnant at the time and weighed about 25 to 30 pounds over her usual weight. Roentgenograms (Fig 1), showed a complete posterior dislocation of the foot, with fractures of the internal malleolus of the tibia, posterior margin of the tibia and shaft of the fibula. Reduction was performed the same day under local anesthesia, and a non padded plaster boot was applied. Postoperative roentgenograms (Fig 2) showed complete reduction. The patient was out of bed within a week and, because of the pregnancy, was permitted to use crutches. She was delivered 1 month after the accident, and remained in bed for 2 weeks. Then weight bearing was cautious, crutches were discarded 1 week later. Because of the non weight bearing period, the plaster was maintained for 10 weeks. Roentgenograms taken after removal of the plaster (Fig 3), showed the reduction had been maintained throughout the period of weight bearing; good union had resulted. About 20 degrees of plantar, and 20 degrees dorsiflexion, were present at the ankle joint, and a fair range of lateral motion. To prevent subsequent edema of the extremity, an elastoplast bandage was applied for 2 weeks. At the end of 3½ months from the day of injury, a complete range of painless motion was obtained.



Fig 9

Fig 9 Case 4 Pott's fracture with lateral subluxation of the foot



Fig 10

Fig 10 Reduced and immobilized in a non padded plaster



Fig 11

Fig 11 Nine weeks after reduction. No weight bearing. Note the osteoporotic changes in bones of the foot which are present.

CASE 2 Female aged 65 years fell and injured her left ankle. Roentgenograms (Fig 4) showed a lateral dislocation of the ankle with fractures of the fibula, internal malleolus and posterior margin of the tibia. Reduction under local anesthesia was performed on the same day; a non padded plaster was applied. Postoperative roentgenograms (Fig 5) showed complete reduction of the dislocation with the fractured fragments in satisfactory alignment. Despite her age and the extent of the injury the patient was permitted out of bed at the end of 1 week. For the first few days she learned to bear weight on the walking iron incorporated in the plaster. No crutches were permitted; the patient learning to rely on a cane for support. At the end of 3 weeks she was able to walk around the house without much difficulty. The plaster was maintained for 7 weeks and on removal roentgenograms (Fig 6) showed that reduction had been maintained in spite of early weight bearing with good callus formation and little if any osteoporotic changes in the bone. She required 4 weeks of physiotherapy. The total duration of disability was less than 3 months.

CASE 3 Female aged 55 years sustained injury to right ankle on February 25, 1933. Roentgenograms (Fig 7) showed a posterior marginal fracture of the tibia with posterior dislocation of the foot similar to the cases described by Dickson. Although from an x-ray standpoint reduction would appear less difficult than in the cases cited previously it was more difficult actually. The astragalus was impinged in back of the tibia; reduction was accomplished with a great deal of difficulty. It was necessary to place a flannel bandage in back of the heel and to use a considerable amount of force to effect reduction. Local anesthesia was used. Following immobilization in a skin tight plaster postoperative roentgenograms showed an excellent reduction. The walking iron was applied; weight bearing without crutches was begun in a week. At the end of 3 weeks the patient was able to walk more than a block at a time. Roentgenograms were taken during this walking interval to check up the position of the fragments. On removal of the plaster on May 1, about 9 weeks later a good solid bony union was obtained (Fig 8). No bone atrophy was found; no pain when weight was borne. Full active function was restored in 3 to 4 weeks. The total disability was about three months.

CASE 4 This case is presented to show the effect of non weight bearing on the duration of disability. The patient, a female aged 35 years, injured her right ankle on February 7, 1936. Roentgenograms (Fig 9) showed a simple Pott's fracture with a lateral subluxation of the astragalus and fractures of the malleoli. Reduction (Fig 10) presented no difficulty and the usual skin tight plaster and

walking iron were applied. The patient lived out of town and hence careful instruction was given as to early weight bearing. Crutches were prohibited. She returned on April 11, about 9 weeks after injury, she walked with aid of crutches but was unable to bear full weight on the extremity. She had failed to follow the advice given because her friends had persuaded her that crutches were necessary and that she had misunderstood instructions. On removal of the plaster roentgenograms (Fig 11) showed osteoporosis with mottling of the bones of the foot and about the ankle. Pressure on the foot was sensitive and painful and she was unable to bear weight on the foot. Motions at the ankle were restricted and painful. She received the usual baking and massage but because of pain was unable to discard her crutches for 4 weeks after which a cane was used for support for 2 months, making the duration of total disability and active treatment run for a total of 5 months.

SUMMARY AND CONCLUSIONS

1. Three different types of fracture dislocation of the ankle are presented, wherein immobilization in a non padded plaster was followed by early weight bearing.
2. When properly applied, the plaster will maintain the reduction throughout the weight bearing period.
3. Weight bearing stimulates callus formation, prevents osteoporosis of the bones.
4. Constant use of the muscles prevents atrophy and stiffening of the ankle joint.
5. The period of total disability is considerably reduced.

REFERENCES

1. BOEHLEKE: Treatment of Fractures. Groves Edition p 430. Baltimore: William Wood & Co. 1935.
2. DICKSON, FRANK: Posterior marginal fracture of the tibia. Surg. Gynec. & Obst. 1933, 56: 525-528.
3. DIETERLE, JOHN: The use of Kirschner wire in maintaining reduction of fracture dislocation of the ankle joint. J. Bone & Joint Surg. 1935, 17: 990-993.
4. TRETHOWAN, W. H.: Fracture Dislocation of the Ankle Joint. In: The Robert Jones Birthday Volume, p 410. New York and London: Oxford University Press, 1938.

METHOD OF INTESTINAL ANASTOMOSIS WITH A NEW CLAMP

HARVEY B STONE, M D, F A C S, Baltimore, Maryland

IT may be said of the making of clamps to aid in intestinal anastomosis, as of the making of books, that there is no end. Many of the men especially interested in intestinal surgery have devised, adapted, or modified some appliance for gut anastomosis, but the writer had always supposed himself immune to this general weakness. Pride goeth before a fall. The instrument herewith presented has proved useful for end-to-end, end to side, and side to side types of operations, in an ample experience, and it is hoped that others may find it worth trying.

The clamp is used in a so called aseptic type of suturing, the general principles of which have been developed in the Parker-Kerr and various other procedures. It acts to close the lumen of the gut during the placing of the sutures, and is withdrawn before the final tying of the sutures. In this form of anastomosis, it is important that the blades be as narrow as possible, so that very little bowel wall will be inverted, otherwise the inverted wall may act as a flange or diaphragm and encroach seriously on the lumen. A number of men use ordinary clamps with the blades ground narrow for this purpose. In some cases such clamps, because the compressive force acts through the hinge and the blades are long and narrow, tend to slip off the gut, or the tips gap apart a little or slip sideways on each other. It was principally to correct this weakness that the clamp herewith described was devised. It has other advantages also and these will be mentioned later.

The clamp consists of two pieces, the hinged jaws and the compressing handle. The jaws are long, narrow, and serrated longitudinally. Close to the outer surface of each jaw tip, a square pyramidal hole is sunk to receive the squared pyramidal points of the compressing handle. The handle is made like any other clamp of the hemostat type operated with finger rings and a ratchet catch, but its blades are bowed like ice tongs and the tip of each blade ends in a squared point to be fitted into the sockets in the tips of the hinged jaw piece. The illustrations make this clearer than a lengthy description and also give dimensions. The latter, of course, may be altered for various purposes.

The technique, for instance of end to end suture, is as follows. The gut is crushed across at the desired levels by crushing clamps leaving a groove. The hinged jaw piece of the clamp herewith described is placed across the gut at the crushed groove and solidly locked in place by setting the handle piece firmly into the sockets in the tips of the jaw piece. The portion of gut to be removed is cut away with the cautery close against the anastomosis clamp. The same process is applied to the other end of the gut to be resected, and the ends to be anastomosed, held firmly by the special clamps, are brought closely together, end to end. A continuous suture of median silk unites the gut walls of each end behind the clamps, which are rotated slightly away from each other during the placing of the suture.

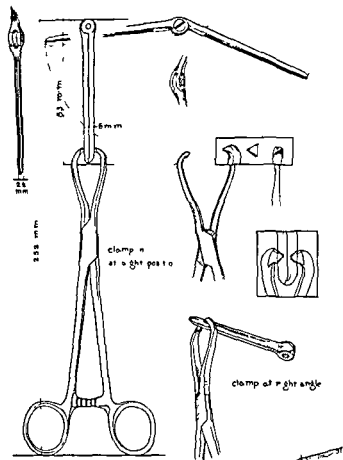


Fig 1 Details of the clamp with dimensions and positions



Fig 2



Fig 3



Fig 4



Fig 5

Fig 2 Manner of placing clamps on bowel before resection of gut.
 Fig 3 Gut resected. Ends to be anastomosed brought side by side. Posterior continuous suture being placed behind clamps. Fixation handles omitted from sketch for simplicity. The two ends of this suture are to be tied.
 Fig 4. Anterior suture being placed over clamp blades. Handles omitted for simplicity.
 Fig 5 Clamps withdrawn. Anterior suture pulled snug closing anastomosis. Ends of anterior and posterior sutures tied together.

The ends of this posterior suture are tied. Now the clamps are rotated toward each other and a similar suture unites the gut walls in front of the clamps but in this suture the ends are not tied but left loose so that the stitch may be drawn taut after the clamps are removed. The compressing handles are now released from the tip of the hinged jaws and set on the hinged joint end instead. By gentle pulling the jaws are withdrawn from between the rows of sutures, front and back, the front row being pulled taut as the jaws of the clamps are slipped out. The corresponding ends of the front and back sutures are tied together and the anastomosis is accomplished. It can be further supported by an additional row of mattress or continuous sutures if so desired.

The squared holes and points of the jaw and handle pieces permit the assembled clamp to take three forms. Jaw and handle may be set together

in the same long axis so that they form a straight line with each other, or they may be clamped together with the handle and blade at right angles to each other, the angle being directed either to the right or left of the surgeon as he may elect. In certain positions this has considerable advantage. For instance several anterior resections of growths rather low in the sigmoid have been done with these clamps. The clamps on the stump of gut are put on with jaws and handle at right angles to each other which permits manipulation in the confined space of the pelvis that would be impossible without this feature.

In summary the clamp possesses firmness and security for use in the "aseptic" type of anastomosis by applying compressive power to the tips of the blades, and also has adaptability because it may be employed as a straight or right angle clamp.

TWO STAGE LOBECTOMY IN THE POOR RISK PATIENT WITH THYROTOXICOSIS

MARSHALL DAVISON, M D, F A C S, and LEON J ARIES, M S, M D, Chicago, Illinois

PREVIOUS to the introduction of iodine as a specific preparatory measure in surgery of the thyroid gland, multiple stage operations such as polar ligation, and, less frequently, lobectomy in two stages were a necessary and frequent procedure. Since the specificity of iodine in the preparation of the usual thyrotoxic patient has been so universally accepted, the use of multiple stage operations has greatly decreased. However, there has been perhaps a failure of appreciation of the fact that while iodine adequately prepares the large majority of thyrotoxic patients, there is still a constant group of patients whose reaction to iodine is inadequate to prepare them for the complete operation, and as a consequence the mortality is sufficiently high to cause one to realize that this is not the procedure of choice. In a large charity service, such as is seen in the Cook County Hospital, in which intensely toxic, neglected, or overiodinized patients are perhaps more frequently seen than in the usual better class groups, we have been faced with the necessity of developing a procedure that would suit the patient, rather than of subjecting the patient to a standardized procedure.

Our earlier efforts in this direction practically were confined to one of the various types of polar ligation. From that experience we cannot agree with the advocates of this operation that such a procedure is followed by constant improvement sufficiently great to warrant it as a step in surgical therapy.

Polar ligation presupposes the vascular supply to and from the thyroid gland to be partially or completely reduced by that procedure. However, anatomically the vascular supply from the superior thyroid artery anastomoses freely with the inferior and superior thyroid vessels of the other side, and, in addition, the *arteria thyroidea ima*, even though inconstant, may arise either from the innominate or from the aortic arch, or may coexist with the inferior thyroid artery or even replace it. Further vascular supply comes also from the prethyroid muscles and periglandular tissues. It has been shown that the arteries of

the thyroid anastomose so thoroughly with those of the trachea and the esophagus that the trunks of all the thyroid arteries may be ligated without fear of necrosis of the gland (x).

Normally, then, there is this rich vascular supply to the gland, but it must be remembered that in thyrotoxic disease this normal vascularity is markedly increased. Polar ligation does not attempt to obstruct all such vessels, but only one or more of the main supply, thyroxin should have, consequently, no difficulty in gaining entrance to the systemic circulation in quantity.

Lahey agrees that ligation of all four poles does not cure the disease, but believes it ameliorates the symptoms in about 66 per cent. He speaks of the technical difficulty in exposing the artery and vein, and of the danger of tearing into the internal jugular vein in attempting ligation of the inferior thyroid vessels. There is no doubt but that the operation of ligating the superior and inferior vessels is a technically difficult procedure, especially in those instances in which one is dealing with a large gland in which the anatomic relations are not normally placed. In working through a small incision with venous bleeding constantly obscuring the field, all difficulties are greatly enhanced. These technical difficulties may, of course, be obviated by visual ligation following flap exposure of the structures, but such a procedure assumes the magnitude of the bilateral subtotal thyroidectomy. It is often a question whether or not in ligations attempted through small incisions, the vessels exposed and tied are correctly identified.

Because of the vascularity of the gland and its inherent richness and anastomosing blood supply, or perhaps because of the occasional failure to ligate the proper vessels either numerically or anatomically, we do not believe that polar ligations are usually followed by sufficient improvement. With this thought, a tentative approach was made to the problem by initiating the procedure of lobectomy in a selected group of cases which ordinarily would have been subjected to polar ligation. The results would seem to show that if a patient is a sufficient risk for polar ligation, he may undergo, with practically equal safety, a unilateral subtotal lobectomy with a

From the Department of Surgery Northwestern University Medical School and the surgical services of the Cook County and University Hospitals Chicago

TABLE I

	Two lobectomies	One lobectomy
Average age—years	38.1	41.2
Average high basal metabolic rate on entrance	58.8	44.8
Average basal metabolic rate following 1st stage lobectomy	26.5	12.5
Average time between operations—months	4.4	
Type of disease		
Thyrocardiacs	9	6
Toxic	9	7
Iodine resistant	5	0
	23	13
Type of gland		
Euphthalmic goiters	22	7
Toxic adenomas	1	6
	23	13
Average duration of disease—years	1.41	1.78
Longest duration—years	5	4.5
Shortest duration—months		2
Mortality—cases	0	1
Total cases	23	13

resultant improvement far greater than could be expected by one or more successive ligations. We are able to report at this time a series of 36 such lobectomies, 23 of which were completed by removal of the remaining lobe. There are 14 of these poor risk patients who have had one lobe removed, 13 of whom at the present time have refused further surgery because of the marked improvement in their condition. There has been one postoperative death in this group occurring in a patient with mitral stenosis and beginning cardiac decompensation.

It is of importance to note that in this series an average reduction in the metabolic rate following removal of the first lobe occurred from an average height of 58.5 per cent to 26.8 per cent within a maximum period of 4 weeks, and so great was the improvement in many of these cases that they were convinced with difficulty as to the necessity of completion of the operation. As we have stated before, 13 of these patients would not return because of what they felt to be a complete cure. This factor is in itself of extreme importance, because in our experience, their improvement will in all cases be temporary and an exacerbation of their symptoms will be the rule and not the exception.

In general, it may be said that the indications for a lobectomy may be classified as those which usually have been advanced for polar ligation. (4) Specifically, they may be classified into the following groups:

TABLE II—TYPES OF DISEASE—SINGLE LOBE REMOVED WITHOUT COMPLETION OF OPERATION

	Age	Basal metabolic rate before	Complication	Duration of disease
Thyrocardiac				
M. W.	61	31	Cardiac asthma with fibrillation	3 years
R. C.	20	10	Marked cardiac damage	1 year
B. H.	40	57	Double mitral with auricular fibrillation	3 months
F. D.	51	53	Angina pectoris	over 1 year
M. S.	42	57	Cardiac asthma	1 year
E. D.	53	15	Hypertension	1 year
Intensely Toxic				
C. Z.	50	68	Fibrillation	3 years
D. L.	30	23	Hypertension	3 years
J. F.	53	47	Arteriosclerosis	3 years
B. K.	45	42	Iodine resistant	2 years
M. K.	41	45	Recurrence	1 year
S. A.	41	82	Hypertension	5 years
L. K.	20	52	Iodine resistant	1 year

1. *Intensely toxic cases* in which patients do not respond satisfactorily to the usual iodine preparation.

2. The so called *iodine resistant glands*.

3. Those with outstanding *cardiac manifestations* not responding satisfactorily to treatment, whose symptoms are due either to primary thyrotoxic myocardial degeneration or are superimposed on an organic heart disease.

4. Those of *advanced age with systemic arteriosclerotic changes*.

5. Those with such associated pathology as would make them poor risks for any surgical procedure.

From the cases charted as shown, the most frequent indication for this procedure is in the group of intensely toxic patients. This group includes those that show little or no response to iodine medication or are iodine resistant because of previously prolonged attempts at iodimization.

As is shown in Table III, the average drop in the basal metabolic rate following removal of the first lobe was 55.5 per cent. There were no cases included in this group which showed a failure in satisfactory reduction in metabolism following the primary lobectomy, nor are there any cases which show a stationary metabolism or a tendency to elevation. All of these metabolic rates

were taken at the time of discharge of the patients from the hospital following surgical recovery from their lobectomy, and demonstrate not only the percentage of metabolic recoveries, but its rapidity following the initial operation

These statistics may be compared to those recently published by Lahey and Schwalm, who report in their series an increase in the basal metabolic rate in 28 per cent of their patients, no change in 6 per cent and a reduction in the rate in 66 per cent of patients following pole ligation

In our group of cases attention also may be called to the rapidity with which the drop in the metabolism takes place, and the comparatively low basal metabolic rate which precedes completion of the operation. As we have stated previously, the ease with which these patients pass through their postoperative course following removal of the second lobe is very much greater than is the course usually seen following the complete operation in the good risk thyroid patient

In contradistinction to the usual procedure of maintaining patients on iodine therapy during the period elapsing between pole ligation and subsequent hemithyroidectomy or bilateral subtotal thyroidectomy, it is our belief that in the period between the stage operations of lobectomy the use of iodine is not indicated after their discharge from the hospital (2). The complete iodization of the remaining lobe that has taken place in the course of the operative preparation should be sufficient to carry these patients during the interval between operations, which optimum time should be from 6 weeks to 3 months. The elimination of iodine therapy during that period lessens the possibility of overiodization, with a resultant increase in risk to the patient from that complication at the time of the second operation. After such a rest period, their response to iodine as a preparatory procedure in the usual manner preceding removal of the remaining side has been extremely satisfactory in all of our cases

Since overiodization is one of the frequent indications for multiple stage operations, it is hardly logical to invite this complication as a possible factor previous to the removal of the remaining lobe

We feel that in the operation of lobectomy there exists a procedure that can replace the operation of polar ligation without increasing the risk of mortality. It would seem that if a patient who is nominally a subject for polar ligation is subjected to a lobectomy the mortality should be no greater, but the consequent improvement should be so much more marked than that following

TABLE III—CLASSIFICATION OF COMPLETED OPERATIONS

Case	Interval between operations	Age	Basal metabolic rate			Duration of disease
			Before	After one lobe	End*	
Iodine Resistant						
S L	5 months	39	54	15	11	2 years
T B	3 months	45	52	18	8	5 months
J W	6 months	46	72	47	14	6 months
A H	2 months	31	62	31	6	2 years
H Y	6 weeks	25	75	37	10	2 years
Thyrocardiac						
M C	2 months	48	31	12	-22	9 months
J P	6 weeks	20	59	?	?	6 months
I S	3 weeks	41	40	20	0	3 months
M C	3 months	50	46	38	4	5 years
F C	8 years	38	40	28	14	1 year
S D	2 months	41	83	32	7	2 years
A W	6 months	46	42	33	11	3 years
M G	3 months	30	72	23	8	9 months
A Z	8 weeks	44	50	28	-8	3 years
Toxic						
M D	4 months	16	74	7	-3	9 months
L S	4 months	57	86	13	-2	5 years
E E	2 years	16	52	27	15	2 months
L B	7 months	34	51	15	7	6 months
H L	3 months	21	78	32	18	6 months
M V	6 weeks	18	82	18	11	1 year
I Z	2 weeks	24	52	40	10	3 months
T C	2 weeks	45	57	17	18	5 months
A L B	9 months	41	44	10	-2	8 months
Average			58.8	26.8	6.5	

*Percentage of 55.5 drop in basal metabolic rate
*Time of basal metabolic rate taken following completion of operation varies

polar ligation that the subsequent operation of completion may be undertaken with a risk less than that usually associated with a bilateral subtotal thyroidectomy in a good risk patient

CONCLUSIONS

1 Thirty-five of 36 thyrotoxic patients who were too poor risks to withstand a bilateral subtotal thyroidectomy have been successfully operated upon by the method of two stage lobectomy

2 Thirteen of 35 patients have refused subsequent operation following primary lobectomy because of the marked improvement in their general condition

3 Primary lobectomy in this series has reduced the average basal metabolic rate from 58.5 per cent to 26.8 per cent, or a percentage reduction of 55.5. There has been a definite drop in the basal metabolic rate in each instance.

4 The postoperative course following the removal of the second lobe is usually milder than that following bilateral subtotal thyroidectomy in the good risk patient.

5 Two stage lobectomy in the poor risk patient with thyrotoxicosis would seem to be the operative procedure of choice, and may replace the operation of polar ligation.

BIBLIOGRAPHY

1. CALLANDER C. LATIMER. *Surgical Anatomy*. Pp 250-252. Philadelphia and London W. B. Saunders Co. 1933.
2. DAVISON MARSHALL, and ARIES LEON J. The fallacy of the use of iodine immediately after bilateral subtotal thyroidectomy. *Surg. Gynec. & Obst.* 1937 64: 999.
3. LAHEY F. H. and SCHWALM L. J. Pole ligation in the treatment of hyperthyroidism with a description of the technique. *Surg. Gynec. & Obst.* 1936 63: 69-76.
4. PEMBERTON, JOHN DEJ. Exophthalmic goiter: indications for the stage operation. *Arch. Surg.* 1929 18: 735.

PONTOCAINE SPINAL ANESTHESIA IN UROLOGY

A LLOYD STOCKWELL, M D, and CLINTON K SMITH, M D, F A C S, Kansas City, Missouri

OUR experiences with pontocaine as a spinal anesthesia in 1000 urological operations serve as the basis for this study. The introduction of pontocaine as a local anesthetic by Schmidt (28), Weidhopf (37), Fussganger and Schuman (8) in 1931 was almost immediately followed by its use as a spinal anesthetic, Schmidt (30, 31), Pfizner (24), Lundy (14), Essex (5), and Marvin (17). Ever since Einhorn introduced procaine, 1904, a search has continued for an anesthetic of similar, but more prolonged action with less blood pressure depression when used intraspinaly. It was early believed that all amino-benzoic acids, alkyl-amino-benzoic acids, di amino-benzoic acids, and amino cinnamic acids could form the basis of alkaline esters which would produce as satisfactory, but more prolonged anesthesia than procaine. Pontocaine is one of the results of this search and is structurally the monohydrochloride of the beta dimethyl amino ethyl ester of 4 butyl-amino-benzoic acid. It is a white crystalline powder with a melting point of 146 to 147 degrees C, which is easily soluble in distilled water or normal saline. A 1 per cent solution is not affected by alkalis in glass, will stand prolonged and repeated heat sterilization, is not changed by brief freezing, remains stable for long periods, is crystal clear, has a hydrogen ion concentration of 5.8, and a specific gravity of 1.0068 at 25 degrees C which compares with spinal fluid averages of 1.001 to 1.009.

The toxicity of pontocaine has been adequately studied by competent observers, but we believe it correct to speak of an absolute, and a relative or clinical toxicity.

Weidhopf demonstrated in a comparative study of toxicity of similar agents that upon intravenous injection, procaine produces death at the dosage of 55 to 60 milligrams per kilogram of body-weight, while pontocaine's lethal dose on the same scale is 6 to 10 milligrams. Upon subcutaneous injection, procaine has a death point of 450 milligrams per kilogram and pontocaine has one of 20 to 30 milligrams per kilogram.

Fussganger and Schuman conclude that pontocaine is about 9 times more toxic than procaine, and death is due to respiratory paralysis. Runge

and Schmidt have concluded that, comparatively, pontocaine is 6 times more toxic than procaine on intravenous dose, but when used on basis that clinically 1 milligram of pontocaine is equal to 10 milligrams of procaine, then pontocaine is actually less toxic. This conclusion is repeated by Schmidt a year later (31). Lundy and co-workers (14, 15) repeated studies on toxicity and conclusions were obtained similar to those of other observers. Marvin states if procaine is given a value of 1 on intravenous toxicity tests, then pontocaine is 5.8 times more toxic, but intraspinaly no alarming reactions occurred with either drug in clinically standardized doses. A comparison showed that 20 to 30 millimeters of mercury drop is the average systolic fall after procaine, but 0 to 10 millimeters of mercury drop is the average after pontocaine.

In the laboratory studies, death from a toxic dose was always due to respiratory failure, because the heart beat continued for some additional time (8). In the only deaths reported following pontocaine (2, 10) the patients ceased breathing some time before the heart stopped. From clinical and laboratory studies following toxic doses of procaine, it is demonstrated that life can be saved if artificial respiration is carried on until spontaneous breathing returns (45, 15). Lundy (5) revived a dog after 7½ hours of artificial respiration following a lethal dose of procaine. Similar conclusions apply to pontocaine. The fate of pontocaine is analogous to that of procaine on which extensive studies of Dunlop and Essex (15, 5) proved that it is the liver that removes procaine from the blood.

From the clinical aspect, toxicity is judged by gastro intestinal reactions, blood pressure and respiratory changes, length of anesthesia, post-operative neurological sequelae, and deaths attributed to the anesthesia. In our series of 1000 operations, there were 65 patients who complained of gastro intestinal distress—58 being nauseated, 7 vomiting. This reaction invariably occurred early in the anesthesia, usually in nervous individuals, and disappeared in 10 to 15 minutes. In several instances it followed too rapid intraspinal injection. Blood pressure readings showed an average fall of 12 millimeters with a maximum of 22 millimeters and a minimum of 4. It is a uniform finding of most investigators that ponto-

caine spinal anesthesia induces only a slight blood pressure fall (2, 3, 6, 9, 19), which is uniformly less than that observed with procaine (41). Respiratory disturbances occurred in 148 of our cases. Shallowness complained of by patient for first 10 to 15 minutes was noted in 87. There were 61 patients requiring moderate stimulation of carbon dioxide and oxygen inhalation for brief periods to overcome transient shallow respiration.

The length of surgical anesthesia has averaged beyond 2 hours (as we rarely tested to deep needle puncture after that time). The shortest duration was $1\frac{1}{2}$ hours, the longest, 3 hours and 5 minutes. The sensation returned on an average of 63½ hours after the intraspinal injection and movements became voluntary shortly after the sensations were perceptible.

The neurological sequelæ were normal. The spinal fluid was examined in 100 cases of conveniently available patients, and fluid obtained at 24 hours on 14, 48 hours on 23, and after 5 to 7 days on 65. At 24 hours an increase in protein was always present, and cell counts varied from 10 to 60. Glucose was occasionally present. At 48 hours albumin occasionally was present, cell count 0 to 15, postoperative headaches never complained of, and reflexes responded as on entrance at physical examination. The 5 to 7 day postoperative specimens showed all normal findings except in 2 patients with syphilis. Of the patients 250, who have been seen 1 and 2 years after operation, normal findings were observed. Schmidt (30) reported on a controlled group of 510 pontocaine spinal anesthesia patients. He had a neurologist examine his patients after 24 to 48 hours, and found normal reflex signs, with spinal fluid changes of slight increase in cell count, rise in protein, and occasional presence of albumin, all of which were returned to normal findings 60 hours after operation. There were less than 5 per cent headaches. At the end of 1 year, the same neurologist examined the same patients and reported all normal findings. Postoperative findings reported by Bull and Esselstyne following pontocaine show no cases of shock, no headache, no neurological sequelæ, normal spinal fluid cell counts but 2 unexplainable deaths, probably due to the anesthetic.

The efficiency and duration of pontocaine induced spinal anesthesia depend upon the method of administration, the controlling factors being the rapidity of injection of the anesthetic, barbotage, the volume injected, the level of the injection, the miscibility of the drug with spinal fluid, and, finally, the position of the patient immediately after the injection. Our procedure

is as follows. Ephedrine sulphate 50 milligrams in 1 per cent procaine is used to anesthetize the spinal needle tract in all patients with blood pressure up to 150 millimeters of mercury, systolic. For hypertensive cases no ephedrine is used. Ephedrine is a direct stimulant to the respiratory center (39) and the coronary (47) and peripheral vascular control (42). Its use in spinal anesthesia was introduced by Rudolph and Graham (44) and Ockerblad and Dillon (43). The lumbar space is chosen and a No. 22, short bevel spinal needle is used for the puncture, and the pontocaine used is a 1 per cent stock ampul solution. The patient is placed level, on his side.

The technique for patients of 135 pounds or over is

No preliminary sedatives except to children. We prefer to administer sedatives, as needed, in the operating room.

For bladder, pelvic, lower extremity surgery—third and fourth lumbar space for 1 hour, 1.5 cubic centimeters of pontocaine with 0.5 cubic centimeter of spinal fluid for 1 to 3 hours, 1.75 to 2 cubic centimeters of pontocaine, no spinal fluid aspirated.

For up to diaphragm, stomach, intestine, gall bladder, kidney, and scrotum—first and second lumbar space for 1 to $1\frac{1}{2}$ hours, 1.75 cubic centimeters of pontocaine with 1 cubic centimeter of spinal fluid, for 1 to 3 hours, 2 cubic centimeters of pontocaine with $\frac{1}{2}$ cubic centimeter of spinal fluid.

The average working dose is 1.75 cubic centimeters for short cases and 2 cubic centimeters for long cases.

Injection is at the rate of 2 cubic centimeters per minute.

The dose for patients under 135 pounds is figured as 1 cubic centimeter of 1 per cent solution for each 100 pounds body weight and to this is added $\frac{1}{4}$ cubic centimeter more for prolonged cases. Two cubic centimeters is the maximum dose.

The patient is turned on his back, kept level, and a pillow is placed under his head. After 10 to 15 minutes, the pontocaine becomes fixed in the tissues and any position desired may be assumed. A warm sensation occurs in feet and ascends the legs; anal reflex and motility disappear and sensation loss to the upper abdomen followed by motility loss, is the usual process. Return of sensation and motility occurs in reverse order after 6 to 7 hours.

A cold towel is applied to the forehead. Unless surgically contra-indicated, we always allow a liberal sucking of ice. If the operation is continued more than an hour, a hypodermic of morphia is

then given in order to prevent restlessness. Upon return to bed, the patient may lie flat on his back or turn on his side, and have a pillow, and start taking fluids. After 6 to 8 hours, if no nausea has been present, we allow a light food intake, unless surgically contra indicated.

The induction is smooth and rapid with an average time of 6 minutes for the appearance of surgical anesthesia. Perfect anesthetics were present in 959 patients, partial anesthetics in 40, of which a few required additional local anesthesia or a few inhalations of nitrous oxide. Complete failure of anesthesia occurred only once. It is of interest to note that the 1 failure and 40 partial failures all occurred in the first 500 cases and the last 500 were perfect, indicating that failure of anesthesia was probably due to faulty technique. The recovery from anesthesia has been uniformly smooth after about 6 to 7 hours.

We have found that the use of pontocaine is indicated in all types of urological surgery as follows:

Cases	Spinal anesthetics
Transurethral resection, prostate	
261 patients—2 stage	522
41 patients—1 stage	41
Cystoscopy (difficult cases, litholapaxy, etc.)	43
Suprapubic cystostomy (stone, tumor, etc.)	61
Suprapubic prostatectomy (39 2 stage)	78
Renal surgery	63
Carcinoma, penis	3
Urethroplasty	22
Manipulation for ureteral stone	78
Scrotal surgery—epididymotomy, hydrocele, undescended testes, orchidectomy	42
Perineal prostatectomy	1
Perineal surgery—abscess, tuberculosis, etc.	42
Ureteral transplants	4

Its distinct advantages are many, particularly the non-toxic effects on the renal function as compared with those of inhalant anesthetics. Since most urological surgery is undertaken on patients with some renal impairment, the use of pontocaine increases our margin of safety. Pontocaine, as was shown, has little to no effect on the blood pressure. In prostatic surgery, we frequently do a suprapubic puncture cystostomy with electrocoagulation of the prostate, depending upon the condition present at the first examination, waiting 6 to 7 days later to do the resection. This method was reported by us previously (46). In each of these procedures, surgical judgment is not hurried by a fading anesthesia, and in the rare cases of unexpected and difficult bleeding ample anesthesia persists for producing perfect hemostasis. In many of the plastic procedures, the time required is longer than anticipated, but we do not have to

hurry. In renal surgery and in intra-abdominal ureteral transplants we obtain perfect relaxation and freedom from gastro-intestinal disturbance and as well sufficient time to cope with difficult situations.

Our youngest patient was 11 years and the oldest 91 years of age. Of the men, there were 867 spinal anesthetics, 270 of which had pontocaine spinal anesthetics twice, 6 had received it 3 times, and 1 had had it 5 times. Spinal anesthesia was given to 133 women, and of these 107 had it once, 13 had it twice.

Two hundred patients were asked their own preference, as to anesthesia. Of this number 49 had once been subjected to inhalation anesthesia, and 38 said they preferred the spinal, of the 151 remaining, 131 said they would prefer the spinal method if a future anesthesia were necessary and 20 said they did not like it.

In this series, there were no deaths attributable to spinal anesthesia.

CONCLUSIONS

Pontocaine spinal anesthesia has been very satisfactory to us in urological surgery. It is slightly more toxic than procaine but when skillfully used no untoward reactions have occurred.

Its distinct advantages are smooth induction, perfect anesthesia for up to, and possibly beyond, 2 hours, complete absence of blood pressure depression, absence of disturbing gastro-intestinal reactions, smooth recovery, and total absence of neurological sequelae.

The safety of any spinal anesthesia depends most upon the skill and experience of the administrator.

BIBLIOGRAPHY

1. BODE, F. Lumbar anesthesia with solution of highly viscous pontocaine. *Chirurg*, 1934, 6, 302-307.
2. BULL, D. C., and ESSELSTYNE, C. B. Pontocaine in spinal anesthesia. *Am J Surg*, 1936, 103, 20-37.
3. CHAMBERD, E. Pontocaine in spinal anesthesia. *Anes & Anal*, 1935, 1, 408-412.
4. ERNST, MAX. Experiences with the new local anesthetic pontocaine. *Muenchen med Wchnschr*, 1931, 78, 0-11.
5. ESSEX, H. I., and LUNDY, J. S. Spinal anesthesia. Clinical and laboratory observations. *Surg Clin N America*, 1932, 12, 1053-1056.
6. FLAMM, L. Pontocaine for lumbar anesthesia. *Wien med Wchnschr*, 1932, 82, 1418-1419.
7. FLORCHEN, H. Pontocaine in surgery. *Muenchen med Wchnschr*, 1935, 82, 92-94.
8. FUSSGANGER, R., and SCRUMAN, O. About new local anesthetic like novocaine (pontocaine). *Arch f exper Path u Pharmacol*, 1931, 160, 53-65.
9. HARPER, W. F. Spinal anesthesia, procaine and pontocaine. *Internat J Med & Surg*, 1933, 46, 376-379.

- 10 HIRSCH CAESAR Pantocaine a new mucous-membrane anesthesia *Deutsche med Wchnschr* 1931 57 15-24
- 11 HULBER W Pantocaine in peridural anesthesia *Muenchen med Wchnschr*, 1935, 82 2007-2004
- 12 LAUBENDER W and OST WILLIAM Pharmacological investigations of two new local anesthetics—pericaine and pantocaine *Arch. f exper Path u Pharmacol* 1932 165 520-537
- 13 LUNDY J S Use of local anesthetics *J Am M Ass*, 1936 107 1469
- 14 LUNDY J S and ESSEY H E New local anesthetic—pantocaine for prolonged anesthesia Laboratory and clinical observations *Proc Staff Meet. Mayo Clin* 1931 6 376-380
- 15 LUNDY J S and TOVELL R M Annual report section on anesthesia 1924 to 1933 *Proc Staff Meet Mayo Clin* 1934 9 235
- 16 LUNTZ G Our experiences with pantocaine *Muenchen med Wchnschr* 1932 79 743-749
- 17 MARVIN FRANK W Pantocaine in spinal anesthesia *New Eng J Med* 1932 66 609-610 Present status of various spinal anesthetics *J Am M Ass* 1933 101 1475-1477
- 18 MOVOP R and DEMBLEAU J Pantocaine in controllable lumbar anesthesia 100 cases *Anes & Anal* 1935 1 408-412
- 19 MCCLUSKEY C F Pantocaine as a spinal anesthetic *Anes & Anal* 1933 12 116-120
- 20 NABI A A Pantocaine L. safe spinal anesthesia *J Egypt M Ass* 1930 19 34-38 *Rev Lancet*, 1936 50 779-780
- 21 NISSEL W Working time of lumbar anesthesia with different preparations *Klin Wchnschr* 1932, 113 570
- 22 Idem Length of lumbar anesthesia with specific lighter solution *Deutsche med Wchnschr* 1932 9 353
- 23 Idem Length of lumbar anesthesia Experiments with pericain and pantocain *Zentralbl f Chir* 1932 59 648
- 24 PRITZNER HANS Clinical experiences with pantocaine *Zentralbl f Chir* 1931 58 1116-1120
- 25 RATHSCHECK W Pantocaine L—new substance for controlled lumbar anesthesia *Schmerz Narkose Anesth* 1935 7 116-127
- 26 RUDGE H, and SCHMIDT H Pantocaine a comparison to cocaine action *Keihlokoeph* 1931 128 232-243
- 27 SCHMECKEL A and BODEN O Pantocaine L in lumbar anesthesia *Zentralbl f Chir* 1934 61 725-732
- 28 SCHMIDT HELMUT A new local anesthetic stronger than procaine (pantocaine) *Chirurg*, 1931 3 97-99
- 29 Idem Pantocaine anesthesia *Schmerz Narkose Anesth* 1931 and 1932 4 277-305
- 30 Idem Pantocaine for lumbar anesthesia *Zentralbl f Chir* 1932 59 1321-1331
- 31 Idem Spinal anesthesia of long duration and fractional dosage in pantocaine anesthesia *Chirurg*, 1932, 4 720-731
- 32 SCHMIDT, H and BORGARD W J Pantocaine as a mucous membrane anesthesia in urology *Ztschr f Urol u Chir*, 1931, 32 40-44
- 33 SCHULBERTH O Poisoning from pantocaine anesthesia *Zentralbl f Chir* 1933 60 1822-184
- 34 SISE J F Pantocaine glucose solution for spinal anesthesia *Surg Clin N America* 1935 15 1501-1511
- 35 SZENTH I Pantocaine for lumbar anesthesia in gynecology *Wien med Wchnschr* 1935 85 360-362
- 36 TOVELL RALPH M Spinal anesthesia *Canadian M Ass J* 1933 28 404-409
- 37 WEIDHOPF O Pantocain a new local anesthetic *Deutsche med Wchnschr*, 1931 1 13-14
- 38 YEAGER G H Spinal anesthesia pantocaine and procaine *Bull School Med Univ Maryland* 1933 18 44-50

General Articles

- 39 CREN K J, and SCHMIDT C F Action and clinical use of ephedrine *J Am M Ass* 1926 87 836-839
- 40 COITT F W and STANDARD S Experimental studies on subarachnoid anesthesia *Surg Gynec & Obst* 1932 55 290-300
- 41 GRAY H T and PARSONS L Blood pressure variations associated with lumbar puncture and anesthesia *Quart J Med* 1911 5 339-343
- 42 MARCU I and GEORGHIOU P Vasoconstriction action of ephedrine *Compt. rend Soc. de Biol*, 1927 90 1447-1451
- 43 OCKERBLAD N and DILLON T G Use of ephedrine in spinal anesthesia *J Urol*, 1929 21 77-82 *J Am M Ass* 1927 88 1135-1136
- 44 RUDOLPH R D and GRAHAM J D Notes on sulphate of ephedrine *Am J M Sc*, 1927 173 399-408
- 45 SEEVERS M H and WATERS R M Respiratory and circulatory changes during spinal anesthesia *J Am M Ass* 1932 99 961-968
- 46 SMITH C K and STOCKWELL A L Preliminary shrinkage of prostate together with histological study of action of coagulating and cutting currents *J Urol* 1935 34 31-42
- 47 STOLAND O O and GINSBERG A M Effect of ephedrine on coronary circulation *J Pharmacol. & Exper Therapy* 1933 49 345-351

EDITORIALS

SURGERY Gynecology and Obstetrics

FRANKLIN H. MARTIN, M.D.
Founder and Managing Editor
1905-1935

ALLEN B. KANAVEL, EDITOR

Associates

LOYAL DAVIS

SUMNER L. KOCH MICHAEL L. MASON

DONALD C. BALFOUR, *Associate, Editorial Staff*

SEPTEMBER, 1937

EMPIRICISM IN MEDICINE

ALTHOUGH medicine is generally credited as being one of the highly specialized branches of science, there are probably few sciences in which empiricism is used more frequently than in the treatment of disease. It is not difficult to see why empiricism has obtained such a hold in medicine when one realizes that the majority of ill patients will recover irrespective of the type of therapy used. Unless one is critical and analytical in his deductions, a particular therapeutic measure is likely to be given credit for improvement or recovery in disease when spontaneous resolution of the process is responsible for the recovery. Another reason why empiricism has continued to persist in medicine is because of the difficulty of drawing conclusions in clinical cases unless an extremely large amount of material is available. The number of variables in a group of cases does not permit standardization of all factors and in this way makes logical conclusions con-

cerning the effects of therapeutics extremely difficult.

Fortunately, at the present time clinicians are relying more and more upon laboratory investigations and in this way are able to minimize the number of variables in a given series of observations so that logical conclusions can be drawn. Also the present day medical student is taught to think logically and not to accept as undoubted truth the teachings of his preceptors and predecessors.

Although Hippocrates had suggested the more or less modern conception of the physiologic treatment of wounds, Galen's teaching that pus was laudable was observed empirically for centuries with undoubtedly a tremendous toll of life and, in addition, prolongation of convalescence and resulting deformity. Even today the laity and many physicians believe that wounds must be actively treated and disregard the fact that resistance of the individual is of most importance. Until relatively recently the almost universally accepted opinion that pre-operative catharsis was not only desirable but also imperative for satisfactory postoperative convalescence of a patient was never disputed, largely because each student of medicine was told by his preceptor that such preparation was necessary. At the present time because of the observation that following emergency operations prior to which catharsis is not justified the postoperative convalescence is smoother and there is less depression of the intestinal activity, clinicians have been convinced that pre-operative catharsis is not only unnecessary but in the majority of instances is actually harmful. Although there are few, if any, surgeons who advocate pre-operative catharsis (except in

certain cases), there are many who believe that gas pains, abdominal distention, nausea, and vomiting should follow every laparotomy and that an absence of these distressing symptoms during the postoperative convalescence is the exception rather than the rule. Unquestionably many patients will continue to have abdominal distention, postoperative pain, and nausea if treated along empiric lines after operation. If, however, the physician will admit that the patient's gastro intestinal tract following a laparotomy is functionally inactive due to stimulation of the splanchnics and if during this period the gastro intestinal tract is treated as any other portion of the body which is inactive, these undesirable metalaparotomy symptoms can be entirely obviated. Sweetened drinks are administered after operation empirically by the majority of physicians, because presumably the carbohydrate is readily available and best tolerated. The ingestion of sweetened drinks by a patient whose gastro intestinal tract is functionally inactive as a result of a physiologic ileus is one of the surest ways of prolonging the ileus, because, as shown by Fine, the readily available carbohydrate is easily fermented and causes increased distention of the bowel, which in turn causes increased secretion. Although the majority of physicians will prescribe fruit juices and other sweetened drinks to patients who have been recently operated upon and believe that they are employing the best form of therapy, they more frequently than not observe that following the ingestion of sweetened drinks abdominal distention is aggravated. Yet, rarely does this observation prevent the ordering of sweetened drinks for their next patient, because for years these drinks have been used empirically during convalescence from operations. Similarly, a patient who has abdominal distention and complains of gas pains is frequently treated by the administration of enemas and

flushes. It is irrational to assume that the gastro intestinal tract which is functionally inactive and already unable to empty itself of its contained fluid and gas will function normally after further overloading it by the administration of additional fluid in the form of an enema. Everything else being equal, the degree, the extent, and the duration of postoperative distention and gas pains are directly proportionate to the number and the size of the enemas and the flushes administered, and yet how many physicians will allow a patient to go 1, 2, or even 4 days without having a bowel evacuation because the necessity of daily evacuation has been empirically used.

Fortunately, because of the physiologic conception of disease and the rational therapy of pathologic conditions based upon physiologic principles, empirical treatment of disease at the present time is becoming less frequently used than previously, and, although many methods must still be used empirically, time will ultimately come when empiricism will become less frequently necessary.

ALTON OCHSNER

THE PASSING OF ENTEROSTOMIES

JUST when the operation of enterostomy was first practiced on man is not known.¹ Lauder says that it was by Heidenhain in 1897. The procedure reached its maximum popularity in this country a few years ago, many surgeons being enthusiastic while others have found it of questionable value. Its object has been principally for drainage of the intestine in cases of ileus, either mechanical or adynamic, and less often for the protection of intestinal suture lines from undue strain by gaseous distention.

¹It was practiced upon horses and cows many centuries ago and as in man some survived it.

Drainage of the intestine has been greatly desired because of the assumption that death from ileus resulted from the absorption of toxic products from the contents of the bowel, though just what these products are has not been determined by the many searchers. The belief in such absorption has obsessed the human race for many centuries, and the surgeon has continued this erroneous idea into his practice. On the other hand, investigation has shown that there is little absorption of toxic products from the bowel, obstructed or otherwise, and particularly is this true if its wall is in a healthy condition. But in spite of the widely known fact that patients with low obstruction survive longer than those with high obstruction, though necessarily having greater intestinal area for absorption, this idea of absorption of toxic products still persists.

The most consistent and significant findings in cases of prolonged ileus, dynamic, adynamic, or paralytic, are loss of fluids, lowering of blood chlorides, increase of potassium and non protein nitrogen and an increase in the combining power of carbon dioxide in the blood. One or more of these may be the fatal factor. Secondly, there may be absorption of toxic products from the intestine when injury to its wall has resulted from impairment of its circulation which results from distention. Accompanying the impairment of the circulation there is also a disturbance of the normal exchange of fluids and gases between the blood stream and the lumen of the bowel.

Since distention plays such an important part in ileus, the enterostomy should be primarily to relieve or prevent it rather than to remove toxic fluids. Again, since in-

testinal gases play such an important part in ileus, their origin must be understood. Experience has shown that abdominal distention does not occur after operation if swallowed air is kept removed from the stomach. Gases produced from putrefaction and digestive processes, contrary to the general belief are insignificant. On the other hand, swallowed air not only comprises probably 80 per cent or more of the intestinal gases, but of more importance is the fact that 79 per cent of air is nitrogen which is not absorbable. A sick patient suffering from nausea swallows more frequently and larger quantities of air than normal, and in a recumbent position eructation is difficult, which accounts for the rapid distention one often sees.

Enterostomy depends upon peristalsis to be efficacious but the traumatism from the operation delays peristalsis. No doubt in certain cases enterostomy may result very favorably, but in extreme cases it only hastens the end.

We are convinced that gastric suction, with few exceptional instances, will accomplish all that can be expected of an enterostomy. Gaseous distention can always be prevented if anticipated, and even after distention has occurred gases can be removed from practically the entire small intestine by suction. The ileocecal valve prevents return of colon contents, and in obstruction to the large bowel, enterostomy (colostomy) is still indicated. It is unnecessary to say that fluids and chlorides removed by suction must be replaced. With greater familiarity and efficiency in the use of gastric suction, the operation of enterostomy need rarely be resorted to.

ALBERT O. SINGLETON

MASTER SURGEONS OF AMERICA

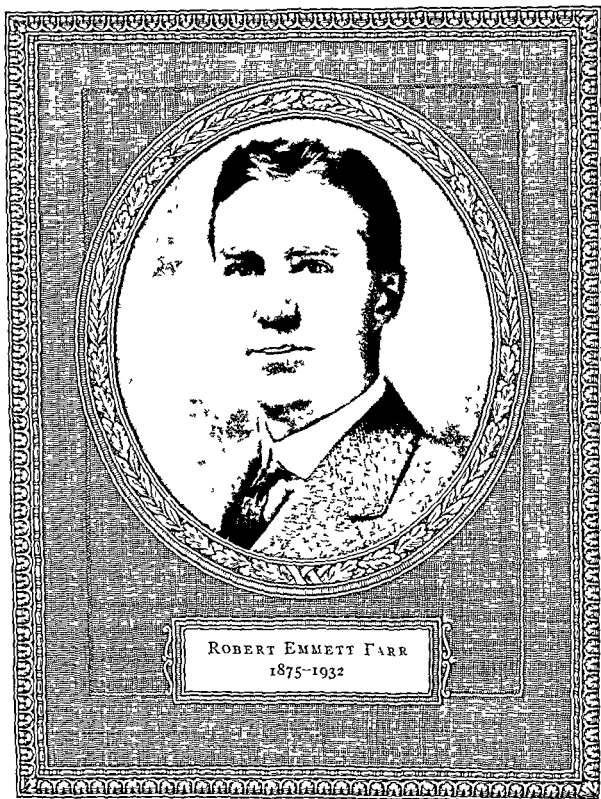
ROBERT EMMETT FARR

ROBERT EMMETT FARR was born in Montello, Wisconsin, in 1875, and received his early education in the schools of that state. He was graduated from Rush Medical School, Chicago, in 1900. He served as interne at St. Mary's Hospital, Minneapolis, in 1900-1901. During his internship he became intimately acquainted with Dr. James Dunn, one of the outstanding surgeons of this community at that time. Later he became associated with Dr. Dunn, and this association continued until terminated by the death of Dr. Dunn.

Dr. Farr was married to Miss Mary Scallen of Minneapolis on April 29, 1902. One son was born to Dr. and Mrs. Farr. The tragic death of this son while he was well along in medical school was a source of much grief to Dr. Farr. The death of Mrs. Farr later added to this seemingly almost unbearable grief.

Dr. Farr was one of those rare individuals who devoted his entire time to the advancement of medicine and surgery. His mechanical turn of mind led him to devote much time to the development of special types of instruments and apparatus as well as special methods of performing operations that might aid in the simplification of surgery. There was no type of general surgery that he did not attempt, and no type that he did not do well.

While his work in all branches of surgery was highly commendable, his special efforts in developing the practicable side of local anesthesia stand out as his greatest achievement. His work with local anesthesia, no doubt, had much to do with creating the spirit of change from the old system of anesthesia. Many men had used local anesthesia at various times, even before the time of Dr. Farr, but no one man ever put forth the enthusiastic effort to establish its use firmly, as did Dr. Farr. He had many ingenious devices, all his own, for the successful administration of local anesthetics. His moving pictures of his technique, among the first of their kind, aroused interest at the various medical meetings throughout the country. While he brought out many practical points in the administration of local anesthetics, his method of establishing anterior splanchnic anesthesia was perhaps his greatest contribution. Anterior splanchnic anesthesia had been done by many men previously, but no other method was so simple and practicable as that of Dr. Farr. Negative intra abdominal pressure was sought by many who attempted this form of anesthesia, but was accomplished by few other than Dr. Farr. Prominent medical men from various parts of this country and abroad visited his clinics, and usually left feeling they had profited by the visit.



ROBERT EMMETT FARR
1875-1932

Dr Farr contributed considerable to medical literature, but his text book on *Practical Local Anesthesia* stands out as his most important contribution in the literary line

The Hennepin County and Minnesota State Medical Societies, as well as many others throughout the country, voted to recommend Dr Farr for the Nobel Prize for his outstanding work in local anesthesia

Although very much occupied with his practice, he was a regular attendant at all important medical meetings and took an active part in the development and organization of all things medical Dr Farr took an active part in establishing *Minnesota Medicine*, now the official journal of the State Medical Association He served several years on its editing and publishing boards and was an important factor in bringing it to its present high standard

He taught surgery at the University of Minnesota from 1902 to 1914, and at the Minneapolis General Hospital from 1906 to 1914 During this time he established himself as a real teacher of the sound principles of surgery

One side of Dr Farr's character was little known to those who were not in close association with him He was generous to a fault Seldom would he fail a friend in need He was always ready to serve his friends professionally or financially if called upon to do so His anxiety to assist the younger men was demonstrated by the generous assistance he gave many of them financially during their time in school as well as during their time of establishing a practice, and although he was by no means a wealthy man, he actually spent considerable sums of money in assisting these younger men

The very unusual hypertrophic condition of his spine which developed comparatively early in his life occasioned him great discomfort and pain Although he was still a young man, he was unable to carry on an active practice during the last 4 years of his life Even with this seemingly insurmountable handicap, he continued to think and do things medical During this time he completed the second edition of his book on *Practical Local Anesthesia* and wrote the chapter on local anesthesia for a popular system of surgery

Dr Farr was past president of the Hennepin County Medical Society, a member of the Minnesota State Medical Association, the American Medical Association, the Minnesota Academy of Medicine, the Western Surgical Association, the American Association of Obstetrical, Gynecological and Abdominal Surgeons, and a Fellow of the American College of Surgeons

Dr Farr's death occurred on June 30, 1932, at Minneapolis

JAMES M HAYES

LANDMARKS IN SURGERY

THOMAS G MORTON AND MORTON'S METATARSALGIA

PHILIP LEWIN, M.D., F.A.C.S., Chicago, Illinois

THOMAS GEORGE MORTON was born in Philadelphia on August 8, 1835, the son of Dr Samuel G. physician and scientist (ethnologist and author of *Crania Americana Egyptiaca*) and Rebecca Grellet Pearsall Morton. He died at Cape May on May 20 1903 of cholera morbus. He studied first in the academic and then in the medical department of the University of Pennsylvania receiving his medical degree in 1856, with a thesis on cataract. He was resident physician to the Pennsylvania Hospital in 1857 and pathologist and curator to its Museum from 1860 to 1864 when he was elected one of the surgeons of the staff. His connection with this hospital continued over forty years. He was surgeon to the Wills Eye Hospital 1859 to 1874 and founder and surgeon to the Orthopedic Hospital—later the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases—with Weir Mitchell co-operating to make it famous. During the Civil War he served almost continuously as acting assistant surgeon.

He was quick and bright always kindly and responsive and especially alive to his civic obligations and to the claims of the poor. He was a notable figure in Philadelphia. His life was one of unusual activity and he performed successfully all of the major operations which in that day established the claim to the title of great surgeon.

He did general practice for three years before devoting his entire time to general surgery. During the Civil War he was active in the military hospitals established in Philadelphia for the care of wounded soldiers. In 1864 he was elected surgeon to the Pennsylvania Hospital. In 1867 he founded the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases and was on its surgical staff until he died. He wrote extensively on mechanical as well as on ophthalmic and blood vessel surgery.

From May 1862 to February 1865 Morton was a colleague of D. H. Agnew at the Mowry Hospital Chestnut Hill Philadelphia the largest army hospital in the United States accommodating five thousand patients. He also organized the army hospital at



Thomas George Morton
1835-1903
(From *American Medical Illustrated Dictionary* courtesy W B Saunders Co.)

Twelfth and Buttonwood Streets, Philadelphia. He was professor of clinical and operative surgery in the Philadelphia Polyclinic for Graduates and his clinical lectures held at the Pennsylvania Hospital were attended by thousands of students. Morton devised a model hospital ward dressing carriage in 1866 which received a certificate of award by the United States Centennial Commission in 1876 a light truck for transferring patients in their beds from ward to clinical amphitheater and an apparatus for measuring inequality in the length of legs.

In 1864 he ligated the common carotid for orbital aneurism in 1866 he amputated at the hip joint in 1867 he tied the subclavian between the scaleni and ligated the left internal iliac artery in 1871 he cured a case of complete osseous ankylosis of the knee by excision in 1877 he removed a dracunculus from the human eye and excised the os calcis—all successfully. He performed the first successful laparotomy for appendicitis with the removal of the appendix on April 27 1886¹ after losing a brother and then a son by this disease on both of whom he had urged in vain the attending surgeons to operate.²

He first described the affection known as metatarsalgia or Morton's toe and devised the operation for its cure. In the January 1876 issue of *The American Journal of the Medical Sciences* Morton published a paper

entitled *A Peculiar and Painful Affection of the Fourth Metatarsal Phalangeal Articulation* in which he reported 12 cases of this disorder and described the anatomic structures and their relations in the lesion which has since been recognized as a clinical entity and is called Morton's toe. Morton's plantar neuralgia or Morton's metatarsalgia.

He wrote

During the past few years I have had under my care a number of cases of a peculiar and painful affection of the foot which so far as I am aware has not been described. In these cases the pain has been localized in the fourth metatarsal phalangeal articulation in several instances it followed at once after an injury of the

¹Tr Coll Phys Phil 1887

²Doctor Ruth mentions an episode which occurred in 1800 or 1801 Morton was quite radical regarding the appendix. Following the death of his two children very early in life from perityphlitis or intestinal abscess which was later found to be appendicitis he advocated the removal of the appendix in all children at the earliest possible age.

From the Division of Surgery Northwestern University Medical School and the Orthopedic Services Cook County and Michael Reese Hospitals

foot in others it was gradually developed from pressure while in others there was no recognized cause

In a report covering the histories and treatment of 12 cases he said

From the number of cases which have been observed it would appear that the affection is not so uncommon only that as a distinct disease it has not heretofore been noticed. Of the 12 cases which I have reported 11 have occurred in females. Besides these I have had 3 other cases making a total of 15 the neuralgia in 8 of the cases was clearly traced to a direct injury to a joint of the fourth toe in 3 or 4 cases it originated from shoe pressure and in the remainder no cause for the pain was assigned. The neuralgic paroxysms and subsequent sensitive condition of the joint referred to in some cases after continuing a variable period without apparent cause became less and less severe inflammatory symptoms were not observed in any of the cases. In several instances where this neuralgia followed an injury a rupture of the ligaments or parts about the joint of the fourth metatarsal was supposed to have occurred

Morton ascribed the neuralgia to the peculiar position which the fourth metatarsal phalangeal articulation bears to that of the fifth, the great mobility of the fifth metatarsal, which by lateral pressure is brought into contact with the fourth, and lastly, the proximity of the digital branches of the external plantar nerve which are, under certain circumstances, likely to be bruised by, or pinched between, the fourth and fifth metatarsals. He attributed the great incidence in females not only to the great delicacy and pliability of the female foot as compared with the male foot, but perhaps in a measure to the prevailing custom, especially with fashionable women, of wearing tight and very narrow shoes. The fifth metatarsal is thus pressed against the head and neck of the fourth. The toes generally

are irregularly crowded together and a painful condition of the foot may be induced and this, kept up, undoubtedly predisposes to more serious consequences

In cases in which this form of neuralgia has been suddenly induced by an injury the treatment should be vigorous local blood letting anodyne applications with long continued rest until all sensitiveness of the joint has disappeared. In chronic cases such as have been described no other treatment except complete excision of the irritable metatarsophalangeal joint with the surrounding soft parts will be likely to prove permanently successful

Morton tried to explain the mechanism of production of this condition and reproduced an illustration showing the plantar nerve with the digital branches of the external plantar to the fourth and fifth metatarsophalangeal articulations with the deeper branches to the same region

Morton recommended in some cases a deep excavation corresponding with the joint of the fourth toe, in the sole of a broad shoe. It is interesting that one of his patients carried a vial of chloroform at all times as the only application which ever relieved her, and that was beginning to lose its effect

In one case Morton said

In this case it would appear that the neuralgia was in the first place caused by a sudden mal position of the metatarsophalangeal joint to the fourth toe incident either to a relaxed state of the joint or to a partial rupture of the ligaments which allowed the head of the bone to slip from its phalangeal articulation thus subjecting the part to unusual pressure

I am indebted to Dr J Torrance Rugh Professor of Orthopedic Surgery Jefferson Medical College Philadelphia for considerable personal data concerning Dr Morton and wish to express herein my thanks

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

IN a volume of some 850 pages Paul Titus presents his study of the *Management of Obstetric Difficulties*.¹ The subject matter is divided into eight sections as follows: sterility; difficulties in diagnosis of pregnancy; complications of pregnancy; complications of labor; obstetric operations; complications of the puerperium; the newborn infant; and a final section on general subjects such as preparation for operation, analgesia, etc. There are 314 well chosen illustrations.

Section I is devoted to sterility and the subject is presented in a complete, clear manner. In addition to discussing the work and methods of others on this subject, Dr. Titus gives a resume of his own work with statistics and presents a finale of precautions in diagnosis and prognosis.

Section II deals with the diagnosis of pregnancy and the difficulties in diagnosis and in determining its duration. The usual methods employed are discussed.

Section III treats of the complications of pregnancy and the major difficulties encountered during pregnancy, each subject being treated according to its importance: ectopic pregnancy, placenta previa, ablatio placentae, and toxemias, each is duly considered and the treatment of each is discussed in a most thorough manner.

Section IV treats of the complications of labor: dystocia due to abnormalities of the uterine contractile forces; developmental anomalies and gynecological abnormalities, with suggestions for the management of labor in all these conditions. Titus gives the (various) methods of pelvic mensuration and the means of determining the presence of a contracted pelvis, along with the various methods of management of labor in such cases. It is regrettable that Dr. Titus has not included the Hillis impression method in his discussion of this subject for it lacks the objectionable features of vaginal manipulations when patient is near term or in labor.

The cause and treatment of intrapartum and postpartum hemorrhage are minutely dealt with and the value of transfusion and uterine tamponade are stressed. The prevention of injuries to the birth canal and the care of such injuries when they do occur are graphically described by word and pictures.

In the section on operative obstetrics the indications for various procedures are clearly set forth with pictures of the operative technique, visualization of the various procedures by drawings or photographs is a most important feature since the

book is obviously intended for the student of obstetrics. An excellent section on the newborn infant stresses the treatment of asphyxia. If the management of this condition as outlined by Titus were generally followed there would be a marked reduction in fetal mortality. The remainder of the book is devoted to the preparation for obstetrical operation, postoperative care, analgesia and anesthesia and the technique of intravenous injections, particularly dextrose solutions and blood solutions.

Titus quotes freely from other sources. If there are diversified opinions concerning the management of a given condition, however, he unhesitatingly states his views and gives his reasons for following any one procedure.

This volume will be most valuable as a ready reference for the student of obstetrics and deserves a place in the obstetrician's library.

CHESTER C. DOHERTY

By experimental and clinical study, Jona of Melbourne has endeavored to elucidate some of the more obscure etiological phases of renal pain. In his book *Kidney Pain*,² the anatomy, physiology and pathology of the kidney, pelvis, calyces and ureters are briefly reviewed. Pyeloscopy with an indwelling catheter has given some interesting observations. Pyelometry studies were carried out on anesthetized dogs and in human beings in conjunction with pyeloscopy and pyelography, the entire investigative procedure usually lasting 1 hour. Many graphs are included showing the variation of intrapelvic pressure on change of body positions and the injections of drugs such as adrenalin, pituitrin, eserine, histamine and others.

Clinical reports illustrating cases of renal pain due to distortion of rhythmical calyceal pelvic and ureteral contractions are presented. Associated pathological abdominal conditions (appendicitis, gall bladder disease) as the exciting factors in a few cases of renal dysfunction are exceedingly interesting. The case of antiperistalsis in which pyelography of the left kidney revealed antiperistalsis and regurgitation of the fluid in the right renal pelvis was well illustrated. On the other hand, some criticism may be offered. As was mentioned, the value of pyeloscopy and pyelometry in the presence of a large ureteral catheter may well be questioned. The normal pelvic capacity of the kidney as 10 cubic centimeters seems too high. The word "infundib-

¹THE MANAGEMENT OF OBSTETRIC DIFFICULTIES. By Paul Titus M.D. St. Louis: The C. V. Mosby Co. 1937.

²KIDNEY PAIN, ITS CAUSATION AND TREATMENT. By J. Leon J. de D. Sc. (Adel.) M.D. (Melb.) M.S. (Adel.) F.R.A.C.S. M.C.O.G. London: J. & A. Churchill Ltd. 1937.

ulum" is invariably erroneously used to designate the renal pelvis. Recommending a nephrectomy only on the basis of a non contracting calyx would seem inconclusive evidence except in rare instances. Citing a septic case of pyelitis cured by an injection of 1 cubic centimeter of pituitrin should be questioned because a catheter was simultaneously passed. The passage of a ureteral catheter alone has cured many cases of febrile pyelitis. While the study and effect of drugs on the renal pelvis and ureter represent an enormous amount of work, the results are not entirely convincing. A slight amount of imagination must be added to interpret all the described favorable influences.

This treatise is valuable in so far that it should stimulate further investigative work in this particular field. The author is to be commended for giving credit to other investigators who have contributed toward the many phases of this so exceedingly interesting study, namely normal physiology and pathology of the renal pelvis and ureter.

L. W. RIBA

NEVER again do I expect to have the responsibility of reviewing so important a book as Dr Miller's *The Lung*.¹ To those who for many years have hoped that it would be written, and these include all who have been in any way interested in the structure of the lung it needs no recommendation. Over a period of nearly 50 years, the name of William Snow Miller has become synonymous with pulmonary anatomy and with a type of painstaking histological research by which alone the finer structure of an organ can be discovered and which few have the devotion and genius to carry out. Dr Miller's first paper on the lung was published in 1892 while he was working in the laboratory of Dr F. P. Mall at Clark College in Worcester, Massachusetts. From that time until the present, in Germany under Werner Spalteholz and for the past 45 years as professor of histology at the University of Wisconsin, he has worked steadily on the same subject and so successfully that he has discovered much that is new and on nearly every disputed point has contributed determining information. Now at the age of 79, he has summarized the results of his studies in this book. It is the history of the development of knowledge concerning the lung and an extremely lucid statement of its present status. It is a record of a unique achievement, of a life singularly devoted to the search for truth, and of an intelligence and temperament singularly adapted to scientific work. It places its author in the class of Vesalius, Fallopius, Willis, and the other great anatomists. It is not a small thing to have advanced knowledge so far in a field where discovery is so difficult. Dr Miller's life and work should be an inspiration to all students of medicine and a criticism of any who may think any phase of it dull or well known.

Dr Miller has been more than a great scientist. In the lecture room, in the laboratory, and, particularly, in his library at the gathering of the medical history club, he has succeeded in transmitting to his students a regard for the high traditions of science and medicine, in imbuing them with the same enthusiasm which he in turn must have received from Mall and of which he has been so good a guardian. His consideration for this phase of his function accounts for his chief idiosyncrasy as a teacher. From each class he selected a small group of the more promising students. He saw that the rest learned what was necessary, these he encouraged and cultivated and on most of them he left his mark. Were his contributions to knowledge not a lasting monument to him, the men whom he has trained and influenced would suffice.

JEROME R. HEAD

THE second edition of White's *Heart Disease*¹ has been predicated upon the popular reception of the first edition. The author has been an active contributor to cardiac literature for some years and is probably America's leading cardiologist. His extensive clinical experience clearly justifies publication of this text.

The author has succeeded splendidly in the difficult task of presenting the voluminous material covering the field of heart disease in a volume of this size. The subject matter is informative, well presented and accurate according to present standards of opinion. The bibliography is particularly well chosen.

The chapters on "rheumatic" heart disease, pulmonary heart disease, and coronary heart disease are especially well presented. The sections on heat in thyroid disease, especially hypertension, and syphilitic heart disease are not of the same standard. The section on disorders of cardiac function contain excellent material on angina pectoris and auricular fibrillation. One might question the division of space allotted to certain types of cardiac disease. Congenital heart disease, of rare occurrence, has been allotted 45 pages while syphilitic heart disease is discussed in a chapter of 12 pages. The student and practitioner may complain of Dr White's frank statement of fact regarding the inadequacy of treatment in many cases. The author has added a well organized appendix on historical data regarding heart disease and the nomenclature of the American Heart Association for diagnosis, which he originally devised. Both of these constitute valuable additions.

The book is somewhat carelessly bound and printed. The type is well selected and the cuts of roentgenograms, electrocardiograms, and pathological specimens are well reproduced.

The book will be generally appreciated and it will undoubtedly rank as the best general text of heart disease on the American market today.

C. C. MAHER

¹THE LUNG. By William Snow Miller. Springfield, Ill. and Baltimore Md. Charles C. Thomas. 1937.

¹HEART DISEASE. By Paul Dudley White, M.D. 2d ed. New York The Macmillan Co. 1937.

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE TECHNIC OF LOCAL ANESTHESIA. By Arthur E. Hertzler A.M. M.D. Ph.D. LL.D., F.A.C.S. 6th ed. St. Louis The C.V. Mosby Co. 1937.

PRACTICAL ENDOCRINOLOGY. SYMPTOMS AND TREATMENT. By Max A. Goldzieher M.D. 2d ed. New York and London D. Appleton Century Co. Inc. 1937.

EVERYDAY FIRST AID. By Walter Frank Cobb M.D. New York and London D. Appleton Century Co. 1937.

HEART FAILURE. By Arthur M. Fishberg M.D. Philadelphia Lea & Febiger 1937.

FISHERIES BEING A SHEAF OF SUNDRY AND DIVERS UTTERANCES CULLED FROM THE LECTURES OF MARTIN H. FISHER, PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF CINCINNATI. By Howard Fabing. A second and enlarged edition by Ray Marr. A private print for his students Springfield Ill. and Baltimore Md. Charles C. Thomas 1937.

CHILD BIRTH YESTERDAY AND TODAY. THE STORY OF CHILD BIRTH THROUGH THE AGES TO THE PRESENT. By A. J. Rony M.D. F.A.C.S. New York Emerson Books Inc. 1937.

SAFELY THROUGH CHILD BIRTH. A GUIDE BOOK FOR THE EXPECTANT MOTHER. By A. J. Rony M.D. F.A.C.S. New York Emerson Books Inc. 1937.

INJURIES AND DISEASES OF THE HIP. SURGERY AND CONSERVATIVE TREATMENT. By Fred H. Albee M.D. LL.D. F.A.C.S. Assisted by Robert L. Preston M.D. New York Paul B. Hoeber Inc. 1937.

CHIRURGIA DELLE VIE OTTICHE INTRACRANICHE. By G. M. Fasiani and G. B. Belloni. Rome Società Tipografica Manuzio 1937.

THE ENDOCRINES IN OBSTETRICS AND GYNECOLOGY. By Raphael Kutzrok Ph.D. M.D. Baltimore The Williams & Wilkins Co. 1937.

TEXTBOOK OF DIAGNOSTIC ROENTGENOLOGY. By Lewis J. Friedman M.D. New York and London D. Appleton Century Co. 1937.

OXFORD MEDICAL PUBLICATIONS. Tweedy's Practical Obstetrics. Revised and largely rewritten by Bethel Solomons M.D. F.R.C.P. F.C.O.G. M.R.I.A. F.A.C.S. (Hon.) and Ninian McIntire Fallner M.D. Sc.D. F.R.C.P. F.C.O.G. 7th ed. New York and London Oxford University Press 1937.

SYNOPSIS OF DIGESTIVE DISEASES. By John L. Kantor Ph.D. M.D. St. Louis The C.V. Mosby Co. 1937.

A TEXTBOOK OF SURGICAL NURSING. By Henry S. Brookes Jr. M.D. St. Louis The C.V. Mosby Co. 1937.

CONSIDERACIONES SOBRE ALGUNAS AFECTACIONES ANO-RECTALES. By Dr. Alfredo Velasco Sanfuentes. Santiago Chile Empresa Periodística El Imparcial 1936.

OPERATIVE SURGERY OF THE EAR, AIR PASSAGES AND NOSE. By Dr. Martin Kirschner. With the collaboration of A.

Lautenschlager and Dr. O. Kleinschmidt. Authorized translation by I. S. Ravdin B.S. M.D. and George M. Coates A.B. M.D. Philadelphia and London J. B. Lippincott Co. 1937.

AN INVESTIGATION INTO QUESTIONS OF SOCIAL HYGIENE IN THE COUNTIES OF VÄSTERBOTTEN AND NÖRREBOTTEN, SWEDEN. Conducted with the support of the Royal Medical Board in 1929-1931. Published in Swedish in 1934. English partly revised edition. Lund Hakan Ohlsson, 1937.

SYNOPSIS OF GYNECOLOGY BASED ON THE TEXTBOOK DISEASES OF WOMEN. By Harry Sturgeon Crossen M.D. F.A.C.S. and Robert James Crossen M.D. 4th ed. St. Louis The C.V. Mosby Co. 1937.

AMERICAN AND CANADIAN HOSPITALS. 2d ed. Chicago Physicians Record Co. 1937.

OBSTETRIC AND GYNECOLOGICAL NURSING. By Frederick H. Falls M.S. M.D. F.A.C.S. and Jane R. McLaughlin B.A. R.N. St. Louis Mo. The C.V. Mosby Co. 1937.

THE PNEUMONOKOTOSIS (SILICOSIS). LITERATURE AND LAW. BOOK III. By George G. Davis M.D. Ella M. Salmons Joseph L. Earlywine. Chicago Chicago Medical Press 1937.

TREATMENT BY DIET. By Clifford J. Barborla B.S. M.S. M.D. D.Sc. F.A.C.P. 3d rev. ed. Philadelphia London and Montreal J. B. Lippincott Co. 1937.

A TEXTBOOK OF HISTOLOGY. By Harvey Ernest Jordan A.M. Ph.D. 7th ed. New York and London D. Appleton Century Co. 1937.

MANUAL OF THE DISEASES OF THE EYE FOR STUDENTS AND GENERAL PRACTITIONERS. By Charles H. May M.D. 15th ed. rev. with the assistance of Charles A. Perera M.D. Baltimore William Wood & Co. 1937.

ROSE AND CARLESS MANUAL OF SURGERY. American 15th ed. Edited by William T. Coughlin B.S. M.D. F.A.C.S. From the 15th English ed. by Cecil F. G. Wakeley D.Sc. (Lond.) F.R.C.S. (Eng.) F.R.S. (Edin.) and John B. Hunter M.C. M.Chir. (Cantab.) F.R.C.S. (Eng.) Baltimore William Wood & Co. 1937.

DISEASES OF THE NERVOUS SYSTEM IN INFANCY, CHILDHOOD AND ADOLESCENCE. By Frank R. Ford, M.D. Springfield Ill. and Baltimore Md. Charles C. Thomas 1937.

SCRITTI DI CHIRURGIA ETERNARIA PER COMMEMORARE IL CINQUANTENARIO DELLA OPERAZIONE DI BASSINI. Vols. 1 and 2. Compiled by G. M. Fasiani and A. Catterina Padua Italy R. Università di Padova 1937.

OXFORD MEDICAL PUBLICATIONS. SKIN DISEASES IN GENERAL PRACTICE. THEIR RECOGNITION AND TREATMENT. By H. Haldin Davis D.M. M.A. Oxon., F.R.C.P. 3d ed. London Oxford University Press 1937.

PRACTICAL TALKS ON KIDNEY DISEASE. By Edward Weiss M.D. Springfield Ill. and Baltimore Md. Charles C. Thomas 1937.

ATLAS OF HEMATOLOGY. By Edwin E. Osgood M.A. M.D. and Clarie M. Ashworth. San Francisco J. W. Stacey Inc. 1937.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York, *President*

VERNON C. DAVID, *Chairman*, MICHAEL L. MASON, *Secretary*, *Committee on Arrangements*

FREDERIC A. BESLEY, Waukegan, *President Elect*

PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

FOR the twenty-seventh annual Clinical Congress of the American College of Surgeons to be held in Chicago, October 25-29, the surgeons of Chicago, under the leadership of a representative committee, will provide a program of clinics and demonstrations that will present a complete showing of the clinical activities in all departments of surgery in this great medical center. The committee is assured of the hearty co-operation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

There appears in the following pages a preliminary schedule of the operative clinics and demonstrations as prepared by the committee. Published in tentative form at this time the clinical program is to be revised and amplified during the months preceding the Congress. Clinics will be arranged for the afternoon of Monday, October 25, and for the mornings and afternoons of each of the four following days.

It will be noted that in addition to an ample and well arranged schedule of operative clinics demonstrating the technique of a wide variety of surgical procedures, the committee has arranged a series of demonstration clinics at the medical schools and in the larger hospitals where the work being done in many special fields will be presented, including neurosurgery, traumatic surgery, thoracic surgery, plastic surgery, fractures, cancer, orthopedics, gynecology and obstetrics, genito-urinary surgery, experimental surgery, physical therapy, roentgenology, ophthalmology, otolaryngology, etc.

The committee has undertaken to so correlate the programs of the participating institutions as to provide the visiting surgeon an opportunity to devote his time continuously, if he so wishes, to clinics dealing particularly with the special subjects in which he is most interested. Thus, it is planned to arrange so that fracture clinics or cancer clinics, for example, will be available each morning and afternoon during the Congress.

The showing of surgical motion picture films, which so faithfully depict clinical features of major interest to most surgeons, will be continued at this year's session with an enlarged program of both sound and silent pictures with daily exhibitions at headquarters.

EVENING SCIENTIFIC MEETINGS

Programs for a series of evening meetings, as prepared by the Executive Committee of the Board of Regents, appear in the following pages. At the opening session on Monday evening—the presidential meeting and convocation—in the ballroom of the Stevens Hotel, Dr. Vernon C. David, Chairman of the Committee on Arrangements, will deliver the address of welcome, following which a number of distinguished foreign guests will be introduced.

The retiring president, Dr. Eugene H. Pool, of New York, will deliver the presidential address which will be followed by the inauguration of the new officers: Dr. Frederic A. Besley, of Waukegan, president, Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schunheim, of Vancouver, vice-presidents. The 1937 class of initiates will be received into fellowship in the College at this session. A feature of this evening's program will be the annual College oration on surgery to be delivered by J. P. Lockhart-Mummery, M.B., B.Ch., F.R.C.S., of London, England.

Papers on surgical subjects of present day importance will be presented by eminent surgeons of the United States and Canada at sessions in the grand ballroom on Tuesday, Wednesday and Thursday evenings.

On Tuesday and Thursday evenings, in the north ballroom of the Stevens Hotel, eminent surgeons who specialize in the fields of ophthalmology and otolaryngology will present and discuss papers of interest to those whose work is limited to these particular fields. A detailed program for these two sessions will be published in the next issue.

AFTERNOON SESSIONS

Cancer—graduate training for surgery—obstetrics and gynecology—industrial medicine and traumatic surgery—fractures provide the subjects for five afternoon conferences

The cancer symposium on Tuesday afternoon, the program for which appears on a succeeding page, will cover a wide field of experience and research. Papers to be presented will discuss types of malignant growths that occur in various organs and glands and will give the results of different kinds of treatment or combination treatment by surgery, radium and x ray. Of particular practical interest will be the presentation by three Philadelphia surgeons of their clinical observations of response to methods of refrigeration in metastatic carcinoma, which will show the correlation of body segmental temperature to this condition. At the conclusion of the session Dr Bowman C Crowell, head of the Department of Clinical Research, will present figures on five year cures of cancer. Three years ago the College reported 24,440 five year cures recorded up to that time.

A conference on graduate training for surgery on Wednesday afternoon (see program in the following pages) is designed to emphasize the importance of more extensive and thorough practice of surgery under supervision before a surgeon embarks upon a more independent career. All Fellows of the College, interested as they are in elevating the standards of their profession and in protecting the public from incompetent practitioners, will want to hear the views of the various speakers on how to provide more opportunities for graduate study and why such study should be encouraged. These views will be presented in a panel discussion in which representatives of various surgical groups will participate. Preceding the discussion a special field representative of the College will present findings from a 1937 survey of opportunities for graduate training provided in hospitals.

A symposium on obstetrics and gynecology will be held on the same afternoon, Wednesday (Program on succeeding page). Not only the specialist in this field but the general surgeon as well, will find the subject matter to be covered in this session of interest.

A conference on industrial medicine and traumatic surgery on Thursday afternoon (see program) will include discussion of many subjects of interest to practitioners outside as well as those in the industrial field, since injuries resulting from accidents in the home, on the athletic field, and on the highways are often similar

in nature to those which are sustained in industrial accidents. New methods of management which have had beneficial results will be described. The Committee on Industrial Medicine and Traumatic Surgery will present the findings of the 1936-1937 surveys and will outline the general trend of medical service as provided by industry.

A symposium on fractures will be held on Friday afternoon (program appears on a succeeding page). Fractures occur so often in industrial accidents that the papers to be presented at this session will have almost equal interest to those of the preceding day for the industrial surgeon. Perhaps in no field of surgery have the results of improved procedures been more evident. The same types of fractures which with methods used a few years ago would have involved serious permanent disablement can now often be managed in such fashion that little or no disability results, and still better practices are constantly being evolved. Some of these will be described at the conference.

Handling of fractures and other traumatic surgery of various kinds will be demonstrated at Chicago hospitals during the week of the Congress. On display in connection with the scientific exhibition at the headquarters will also be apparatus and instruments for use in traumatic surgery.

HOSPITAL CONFERENCE

Stressing those elements in hospital service which contribute most to the best possible care of the patient, the program for the twentieth annual hospital standardization conference (see detailed program in the following pages) presents opportunity for discussion of most of the important problems of hospital operation.

The regular sessions of the conference will be held at the Stevens Hotel every morning from Monday until Thursday, and the afternoons of the same days except Wednesday, when demonstrations will be given in a number of Chicago hospitals.

At the opening session on Monday morning, Dr Eugene H. Pool, president of the American College of Surgeons, will deliver an address, which will be followed by the report of the 1937 survey of hospitals and official announcement of the approved list by Dr George Crile, Chairman of the Board of Regents. At the same session four important talks on the various obligations of the hospital personality and psychology in the hospital, selection of internes and residents, and the effect upon medical and hospital services of hospital insurance plans will be presented.

The entire session Monday afternoon will be devoted to the medical staff conference, with consideration of how, when and where to hold it, the proper attitude toward it, and the results that may be expected. A feature of the program will be a model staff conference staged by the medical staff of the Ravenswood Hospital.

Organization, direction, control, and functioning of the clinical departments of the hospital will be considered at the Tuesday morning session, and the management of hospital personnel will be discussed from various viewpoints on Tuesday afternoon.

In view of the obvious desirability of considering more deeply the public relations of hospitals, an entire session on Tuesday evening will be devoted to discussion of this problem. This will be a joint session with the Chicago Hospital Council and the Chicago Hospital Association. Charles H. Schweppe, president of the former body, will preside. Talks are scheduled on how best to co-operate with the press in the handling of news involving hospitals, and how hospital administrators, hospital trustees, and members of the staff may aid in improving relations with the public.

Record librarians, whose behind the scenes activities furnish the basis for much of the progress in procedures in caring for the patient, will unite through their organization, the Association of Record Librarians of North America, with the hospital standardization conference in a joint session on Wednesday morning. How to evaluate medical records, how to develop a medical record consciousness in the hospital, the remunerative value of good records, and other phases of record keeping will be discussed. The Medical Record Librarians of Chicago will furnish a graphic illustration of how to co-operate in their activities in the hospital by presenting a sketch, "The Medical Record Librarian's Dream Comes True."

Co-operating with the conference, sixteen Chicago hospitals and the University of Chicago Clinics will hold demonstrations on Wednesday afternoon of many phases of hospital operation, from the organization and maintenance of a psychiatric department to the handling of laundry. Selection of the demonstrations which delegates wish to attend should be made at the time of registering.

The Thursday sessions will be conducted as panel round table conferences. Discussion on the various topics will be led by experts in each field. The general theme will be hospital administration and standardization problems. Business methods, call systems, nursing service, social

service, air conditioning, income and technical service standards will be discussed at the morning session, standardization of furnishings, equipment and supplies, food service, professional problems of the small hospital, and other topics will be discussed at the afternoon session.

Hospitals in Chicago and vicinity will welcome visits by delegates to the conference and opportunity for such visits will be given on Friday. Information should be obtained at the headquarters for hospital registration and information at the Congress.

HEADQUARTERS AND TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Stevens Hotel where the grand ballroom with its large foyers and other meeting-rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments, x-ray apparatus, operating room lights, hospital apparatus and supplies of all kinds, ligatures, dressings, pharmaceuticals and publishers of medical books will be represented.

ADVANCE REGISTRATION

The hospitals and medical schools of Chicago afford accommodations for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be definitely limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheatres, operating rooms, and laboratories of the hospitals and medical schools to determine their capacity for visitors. Therefore, those surgeons who wish to attend the Congress are expected to register in advance.

A registration fee of \$5.00 is required of each surgeon attending the Annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card, which is non-transferable, must be presented to secure clinic tickets and admission to evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, the number of tickets issued for any clinic being

limited to the capacity of the room in which that clinic is given. This plan provides an efficient means for the distribution of the visiting surgeons among the several clinics and insures against overcrowding.

RAILWAY RATES

Although no special rates have been authorized by the railways for the Clinical Congress in Chicago this year, and certificates will not be required the railways in the western, northwestern, southwestern, and southeastern states will offer for sale in October round trip tickets to Chicago at very low rates, with a 30-day return limit in certain territory and a 15 day return limit in other territory. Complete information as to rates, routes, and stop-over privileges may be obtained from local ticket offices. In the territory east of Chicago, north of the Ohio and Potomac Rivers including the north Atlantic and New England states and eastern provinces of Canada the regular rate of three cents per mile in pullmans and two cents per mile in coaches will be in effect.

CHICAGO HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Stevens, there are several first class hotels within short walking distance of headquarters, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee.

	Minimum Rate with Bath	
	Single	Double
Auditorium 430 S. Michigan Ave	\$2 50	\$4 00
Bismarck 171 W. Randolph St	3 50	5 00
Blackstone Michigan Ave at 7th St	4 00	6 00
Congress 500 S. Michigan Ave	3 00	5 00
Drake Michigan and Lake Shore Drive	4 00	6 00
Great Northern 237 S. Dearborn St	2 50	4 00
Harrison 57 E. Harrison St	2 50	3 50
Knickerbocker 163 E. Walton Pl	3 00	5 00
LaSalle 10 N. LaSalle St	3 00	4 50
Morrison 70 W. Madison St	3 00	4 00
Palmer House 15 E. Monroe St	3 50	5 00
Sherman 106 W. Randolph St	2 50	4 00
Stevens 720 S. Michigan Ave	3 00	4 50

PROGRAMS FOR AFTERNOON SESSIONS

SYMPOSIUM ON CANCER

Tuesday 2 00 P M—ballroom Stevens Hotel

CHARLES A. DUKES, M.D., Oakland, Chairman of Committee on the Treatment of Malignant Diseases presiding

Correlation of Body Segmental Temperature and Its Relation to Metastatic Carcinoma. Clinical Observations and Response to Methods of Refrigeration. TEMPLE FAY, M.D., GEORGE HEANY, M.D., and AUGUSTUS McCRAVEY, M.D., Philadelphia

Topic to be announced. J. P. LOCKHART MUMMERY, M.B., B.Ch., F.R.C.S., London

Paget's Disease of the Nipple. SIR GEORGE LENTHAL CHEATLE, F.R.C.S., London

Cancer of Esophagus. JOHN H. GARLOCK, M.D., New York

Carcinoma of Thyroid. HAROLD L. FOSS, M.D., Danville, Pa.

The Role of Cystectomy in Malignant Tumors of the Bladder. CHARLES C. HIGGINS, M.D., Cleveland

Presentation of Five Year Cures. BOWMAN C. CROWELL, M.D., Chicago

OBSTETRICAL AND GYNECOLOGICAL CONFERENCE

Wednesday, 2 00 P M—North Ballroom, Stevens Hotel

FRANK W. LYNCH, M.D., San Francisco, Vice President, American College of Surgeons presiding
Conservatism in Obstetrics. GEORGE W. KOSMAK, M.D., New York

Water Balance in Relation to Toxemias of Pregnancy. M. EDWARD DAVIS, M.D., Chicago

Abdominal and Pelvic Pain from the Gynecological Viewpoint. ARTHUR H. CURTIS, M.D., Chicago

Cesarean Section. JOHN R. FRASER, M.D., Montreal

Differential Diagnosis in Intestinal, Urinary and Gynecological Diseases. FLOYD E. KEENE, M.D., Philadelphia

Syphilis in the Pregnant Woman. JAMES R. MCCORD, M.D., Atlanta

CONFERENCE ON GRADUATE TRAINING FOR SURGERY

Wednesday, 2 00 P M —Ballroom, Stevens Hotel

FREDERIC A BESLEY, M D, Waukegan, Ill, President, American College of Surgeons, presiding
 Opening Remarks GEORGE CRILE, M D, Cleveland, Chairman, Board of Regents, American College of Surgeons
 Purpose of Conference MALCOLM T MACEachern, M D, Chicago, Associate Director, American College of Surgeons
 Graduate Training for Surgery ALTON OCHSNER, M D, New Orleans
 Findings from the 1937 Survey of Hospitals by the American College of Surgeons MELVILLE H MANSON, M D, Minneapolis, Special Field Representative

Panel discussion from the following viewpoints

The Surgeon in the Teaching Hospital DALLAS B PHEMISTER, M D, Chicago
 The Surgeon in the Large Non Teaching Hospital DONALD GUTHRIE, M D, Sayre, Pa
 The Surgeon in the Rural Community Hospital HOWARD L SNYDER, M D, Winfield, Kan
 The American Surgical Association EUGENE H POOL, M D, New York
 The American Board of Surgery EVARTS A GRAHAM, M D, St Louis
 The American Medical Association FRED W RANKIN, M D, Lexington, Ky
 Significant Experiences in the Training of Surgeons on a Graduate School Basis LOUIS B WILSON, M D, Rochester, Minn
 Discussion Otolaryngology—PERRY G GOLDSMITH, M D, Toronto, Urology—FRANK HINMAN, M D, San Francisco, Gynecology and Obstetrics—ARTHUR H CURTIS, M D, Chicago

SYMPOSIUM ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

Thursday, 3 00 P M —Ballroom, Stevens Hotel

FREDERIC A BESLEY, M D, Waukegan, Ill, Chairman of Committee on Industrial Medicine and Traumatic Surgery, presiding
 Recognition and Prevention of Lead Poisoning ROBERT ARTHUR KEHOE, M D, Cincinnati
 Reconstruction Surgery of the Face and Jaws DR MED WOLFGANG ROSENTHAL, Leipzig
 Injuries of the Chest and Abdomen EDMUND BUTLER, M D, San Francisco
 The Modern Concept of the Industrial Medical Problem M N NEWQUIST, M D, Chicago
 Reconstruction of Scalp and Ear by Tube Graft Method JAMES A CAHILL, JR, M D, Washington, D C
 Physical Therapy in Relation to Industrial Surgery KRISTIAN G HANSSON, M D, New York

SYMPOSIUM ON FRACTURES

Friday, 2 00 P M —Ballroom, Stevens Hotel

FREDERIC W BACROFT, M D, New York, Chairman of Committee on Fractures, presiding
 Organization of Regional Fracture Groups CHARLES L SCUDDER, M D, Boston
 Functional Disabilities after Simple Fracture FRASER B GURD, M D, Montreal
 Fractures of the Shaft of the Humerus J HUBER WAGNER, M D, Pittsburgh
 Fractures of the Bones of the Hand HUBLEY R OWEN, M D, Philadelphia
 Malunion in Fractures WILLIS C CAMPBELL, M D, Memphis, Tenn
 Fracture of Both Bones of the Forearm (excluding Colles' Fracture and Fractures into the Elbow Joint)
 WILLIAM B CARRELL, M D, Dallas, Texas

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Convocation—Monday, 8 00 P M—Ballroom, Stevens Hotel

Address of Welcome VERNON C DAVID M D, Chicago, Chairman, Committee on Arrangements
 Introduction of Foreign Guests
 Address of the Retiring President EUGENE H POOL, M D, New York
 Inauguration of Officers
 Conferring of Fellowships FREDERIC A BESLEY, M D, Waukegan, Ill President
 Conferring of Honorary Fellowships The President
 Annual Oration on Surgery The Surgeon as a Biologist J P LOCKHART MUMMERY, M B, B Ch,
 F R C S, London, England

Tuesday, 8 00 P M—Ballroom Stevens Hotel

Treatment of Peptic Ulcer
 Indications for Surgery JAMES H MEANS, M D Boston
 Technique of Surgical Treatment ROSCOE R GRAHAM M D Toronto
 Nucleus Pulposus and Lower Back and Sciatic Pains HOWARD C NAFFZIGER M D, San Francisco
 The Relation of Chronic Cystic Mastitis to Cancer of the Breast DEAN LEWIS, M D, Baltimore

Wednesday, 8 00 P M—Ballroom, Stevens Hotel

Lymphedema
 The Genesis and Consequences of Lymphedema CECIL K DRINKER, M D, Boston
 Circulatory and Lymphatic Disturbances in the Abdomen WILLIS D GATCH M D, Indianapolis
 Diverticula of the Intestine CLAUDE F DIXON M D Rochester, Minn
 Immediate or Delayed Treatment of Acute Cholecystitis (Liver Shock and Death) HENRY W CAVE
 M D, New York

Thursday, 8 00 P M—Ballroom, Stevens Hotel

Tuberculosis of the Kidney FRANK HINMAN M D, San Francisco
 Physiological and Pathological Changes in the Urinary Tract during Pregnancy J MASON HENDLEY
 JR, M D, Baltimore
 Acute Pancreatitis IRVIN ABELL M D Louisville
 Fracture Oration The Present Status of the Operative Treatment of Fractures WILLIAM O NEILL
 SHERMAN, M D, Pittsburgh

Community Health Meeting—Friday, 8 00 P M—Ballroom Stevens Hotel

Program in preparation

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday 10 00—Ballroom Stevens Hotel

EUGENE H POOL M D New York President American
 College of Surgeons presiding
 President's Address
 Report of the 1937 Survey of Hospitals and Official An
 nouncement of the Approved List GEORGE CRILE
 M D Cleveland Chairman Board of Regents Amer
 ican College of Surgeons
 The Approved Hospital and Its Obligation—Diagnosis
 and Therapy Education Prevention and Research
 BERT W CAMPBELL M D Chicago
 Personality and Psychology in the Hospital G HARVEY
 AGNEW M D Toronto

Trends in Medical Education JOHN H J UPHAM M D
 Columbus Ohio
 Criteria to be Observed When Selecting Internes and
 Residents JAMES H MEANS M D Boston
 The Effect Hospital Insurance Plans Are Having on
 Medical and Hospital Services C RUTUS ROEM
 Ph D Chicago

Monday 4 00—Ballroom Stevens Hotel

GEORGE E WILSON M B Toronto Vice President
 American College of Surgeons presiding
 The Medical Staff Conference—with Panel Discussion from
 the Following Viewpoints

General Presentation of Subject HAROLD L. FOSS, M.D.,
Danville, Pa.
Proper Attitude of the Medical Staff JAMES T. NIX,
M.D., New Orleans
Time, Place and Physical Essentials WILLIAM H. WALSH,
M.D., Chicago
Conduct of the Conference EDWARD I. TUOHY, M.D.,
Duluth, Minn.
Criteria of a Good Medical Staff Conference FELIX P.
MILLER, M.D., El Paso, Texas
Demonstration—A model medical staff conference by the
medical staff of Ravenswood Hospital, Chicago

Tuesday, 10:00—Stevens Hotel

F. WELDON YOUNG, M.D., Seattle, Wash., presiding
Clinical Departments of the Hospital, Embracing Organi-
zation, Direction, Control, Functioning
Oral Surgery and the Dental Department in the General
Hospital WILLIAM H. G. LOGAN, M.D., Chicago
Psychiatric Department in the General Hospital SAMUEL
W. HAMILTON, M.D., New York
The Physical Therapy Department in Small, Medium and
Large General Hospitals JOHN S. COULTER, M.D.,
Chicago
The Outpatient Department in the General Hospital
CHRISTOPHER G. PARNALL, M.D., Rochester, N.Y.
The Obstetrical Department in the General Hospital
OTTO H. SCHWARZ, M.D., St. Louis

Tuesday, 2:00—Stevens Hotel

FRED G. CARTER, M.D., Cincinnati, presiding
Hospital Personnel Management—with Panel Discussion
from Various Viewpoints
General presentation of subject FRANK J. WALTER,
Denver
Selection E. MURIEL ANSCOMBE, R.N., St. Louis
Physical Health HAROLD L. SCAMMELL, M.D., Halifax
Assignment of Duties CLYTON F. SMITH, Chicago
Working and Living Conditions JOSEPH G. NORBY,
Milwaukee
Morale MACIE N. KNAPP, R.N., Normal, Ill.
Training and Education of Hospital Personnel GEORGE
O'HANLON, M.D., Jersey City, N.J.

Tuesday 8:00 P.M.—Stevens Hotel

Joint Session—with Chicago Hospital Association and
Chicago Hospital Council CHARLES H. SCHWEPPE, Chi-
cago, presiding
Public Relations—with Panel Discussion from the Follow-
ing Viewpoints
General presentation of subject PERRY ADDLEMAN,
Chicago
The Hospital Administrator ADA BELLE McCLEERY,
R.N., Evanston, Ill.
The Member of the Medical Staff FREDERIC J. COTTON,
M.D., Boston
The Press HOWARD W. BLAKESLEE, New York
Fund Raising PAUL E. FESLER, Chicago
Community Good Will A. EDWARD A. HUDSON, Waynes-
boro, Va.

Wednesday 10:00—Stevens Hotel

Joint Session with Association of Record Librarians of

North America R. C. BUEKEL, M.D., Madison, Wis.,
presiding
Developing a Medical Record Consciousness in the Hos-
pital SISTER M. PATRICIA, O.S.B., B.S., R.R.L.,
Duluth, Minn.
What Constitutes a Proper Appraisal of the Medical
Record CHARLES B. PUESTOW, M.D., Chicago, and
LILLIAN H. ERICKSON, R.R.L., Milwaukee
Incomplete Medical Records—Causes and Remedies
ALICE G. KIRKLAND, R.R.L., Oakland, Calif.
The Remunerative Value of Good Medical Records
RICHARD B. DAVIS, M.D., Greensboro, N.C.
The Technique of Making Good Studies of Diseases
THOMAS R. PONTON, M.D., Chicago
Sketch—The Medical Record Librarian's Dream Comes
True Presented by the Medical Record Librarians of
Chicago

Wednesday, 2:00

Demonstrations in the following Chicago hospitals
Chicago Memorial, Children's Memorial Cook County,
Grant, Henrotin, Michael Reese, Passavant Memorial,
Presbyterian, Ravenswood, Research and Educational,
St. Elizabeth's, St. Joseph's, St. Luke's, St. Mary of
Nazareth, University of Chicago Clinics, Wesley
Memorial West Suburban

Thursday, 10:00—Stevens Hotel

Panel Round Table Conference—Problems Relating to
Hospital Administration and Hospital Standardization
Conducted by ROBERT JOLLY, Houston, Texas, and
R. C. BUEKEL, M.D., Madison, Wis.
Call Systems for Hospitals JOHN GORRELL, M.D., Grand
Rapids, Mich.
Administrative Problems of the Small Hospital GLADYS
BRANDT, R.N., Logansport, Ind.
Nursing Service SISTER MARY LUDWIG, Chicago
Medical Social Service Standards BABETTE JENNINGS,
Chicago
Air Conditioning in Hospitals PERRY W. SWERN, Chicago
Hospital Income BRYCE L. TWITTY, Dallas, Texas

Thursday, 2:00—Stevens Hotel

Standardization of Hospital Furnishings, Equipment and
Supplies L. M. ARROWSMITH, Brooklyn
Food Service MIRIAM C. CONNELLY, Baltimore
Professional Problems of the Small Hospital MARY E.
SALOCH, R.N., Marquette, Mich.
Nursing Education MARY M. ROBERTS, R.N., New York
Outpatient Department FREDERICK MACCURDY, M.D.,
New York
The Cancer Clinic in the General Hospital FRANK E.
ADAIR, M.D., New York
The Hospital Pharmacy EDGAR C. HAYHOW, Paterson,
N.J.
The Front Office of the Hospital LEE C. GAMMILL,
Little Rock, Ark.

Friday

An opportunity will be afforded the hospital delegates
to visit Chicago hospitals. Special information pertain-
ing to each institution will be available at the hospital
registration and information desk.

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS GENERAL SURGERY, GYNECOLOGY AND OBSTETRICS, ORTHOPEDIC SURGERY, GENITO URINARY SURGERY, THORACIC SURGERY, FRACTURES, AND TRAUMATIC SURGERY, NEUROSURGERY, EXPERIMENTAL SURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, PHYSICAL THERAPY, ROENTGENOLOGY, TUMORS AND IRRADIATION, OPHTHALMOLOGY, OTOLARYNGOLOGY

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL

CHARLES J DRUECK SR GEORGE L BROOKS OTTO SAPHIR and GEORGE LANDAU Symposium Carcinoma of the rectum carcinoma of the colon
CHARLES E KAILKE GEORGE L BROOKS OTTO SAPHIR and GEORGE LANDAU Symposium Peptic ulcer

PASSAVANT MEMORIAL HOSPITAL

SUMNER L KOCH MICHAEL L MASON and HARVEY S ALLEN Surgery of the hand Dupuytren's contracture Volkmann's contracture nerve and tendon suture burn contractures of the hand and plastic repair with skin grafts chronic tenosynovitis

ST ANTHONY DE PADUA HOSPITAL

R C DRURY Spinal anesthesia

ST BERNARD'S HOSPITAL

R J FASIO Blood transfusion merits of methods

ST LUKE'S HOSPITAL

T HANSON and J JANSEN Treatment of comminuted fractures of the leg

WOMEN AND CHILDREN'S HOSPITAL

CLEMENTINE FRANKOWSKI and HELEN M KOSTKA Varicose veins treatment by injection and by ligation

Tuesday Morning

AUGUSTANA HOSPITAL

N M PERCY Operations

ALBERT MERRITT BILLINGS HOSPITAL

Clinical Demonstrations

LESTER R DRAGSTEDT and staff Clinical and experimental studies in gastric and duodenal ulcer
WALTER L PALMER F E TEMPLETON and RUDOLF SCHINDLER X ray and gastroscopic studies of gastric ulcer under medical treatment
A BRUNSCHWIG Pancreatoduodenectomy for carcinoma of the head of the pancreas
H P JENKINS Abdominal wound disruptions and the durability of catgut sutures

CHICAGO MEMORIAL HOSPITAL

CHARLES E KAILKE Stomach surgery
CHARLES J DRUECK SR Surgery of the colon and rectum

COOK COUNTY HOSPITAL

KARL A MEYER R H JAFFE M J HUBENY AARON ARKIN and RUDOLF SCHINDLER Symposium Surgery of the stomach Operations
DR GATEWOOD Children's surgery
GEORGE G DAVIS ALBERT H MONTGOMERY JOHN HARGER HARRY JACKSON and JOHN G FROST Operations

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine 427 S Honore Street.

EVANGELICAL DEACONESS HOSPITAL

EDWARD N HEACOCK Cholecystectomy

GARFIELD PARK HOSPITAL

EDMUND FOLEY PAUL SCHMITT HAROLD WAIT SAMUEL PRICE CLAUDE WELDY and FRED DE STEFANO Symposium Gall bladder disease

HOLY CROSS HOSPITAL

V F TORCZYNSKI Cholecystectomy, appendectomy, hysterectomy
M J BADEMIEROWSKI Thyroidectomy 5 cases cholecystectomy
J P DYBALSKI Cholecystectomy 3 cases nephrectomy hysterectomy
A J MANIKAS Appendectomy

JACKSON PARK HOSPITAL

G M LUCAS Clinic
W MORLEY SHERIN Gall bladder surgery
Symposium Appendicitis
A BAMBERGER Surgical aspect
R R JAMIESON Medical aspect
J J MOORE Pathological aspect

LUTHERAN DEACONESS HOSPITAL

JOHN D KOUCKY G H MAMMEN and GEORGE H SCHROEDER Operations

MERCY HOSPITAL

Dry Clinic

C F SAWYER and associates Unusual causes of intestinal obstruction partial and complete gastrectomy
M MCGUIRE and associates Pelvic appendicitis obstructive jaundice

MOUNT SINAI HOSPITAL

V SCHRAGER Operations
J GAULT Technique of high internal saphenous vein ligation
P KAPLAN Tubulovascular gastrostomy

PRESBYTERIAN HOSPITAL

KELLOGG SPEED ALBERT H MONTGOMERY DR GATEWOOD and associates Operations
V C DAVID C B DAVIS and E M MILLER Dry clinics

RAVENSWOOD HOSPITAL

Dry Clinic

P J SARMA Varicose veins ligation and obliterative treatment
R E DYER End results of gastro-enterostomies demonstration of cases

D B POND and R F GREENING Osteomyelitis
 J J MOORE Tumors of breast
 D L JENKINSON X ray interpretations
 GEORGE DE TARNOWSKY Extrophy of bladder
 C J GEIGER Ectopic ureter and absence of vagina, cervical carcinomas
 M W FIELD Obstetric practice by general practitioner
 W F GROSVENOR Toxemia in pregnancy
 W C HAMMOND Endometriosis

MICHAEL REESE HOSPITAL

D C STRAUS Thyroid operations
 RALPH B BETTMAN and WILLIAM TANNENBAUM Gall bladder surgery
 A A STRAUSS Gastro intestinal surgery
 JAMES PATEJDL Operations
 P SHAPIRO Operations

Symposium Gastro Intestinal Diseases

A A STRAUSS Surgical treatment of peptic ulcer
 S STRAUSS Pre and postoperative care of the patient
 JAMES PATEJDL Perforating ulcer, surgical treatment
 JACOB MEYER Medical care of the ulcer patient
 Symposium Carcinoma of the Rectum
 A A STRAUSS Surgical
 S STRAUSS Surgical diathermy, after care and results of surgical diathermy
 M APPEL Histocytic variation in cancer tissue
 GUSTAV KOLISHER History of surgical diathermy
 OTTO SAFHIR Pathology of the rectum following surgical diathermy

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DETAKATS Lumbar sympathectomy operation
 Symposium Neurocirculatory Diseases
 R BRUNNER Use of neosynephrine in spinal anesthesia
 WILLIAM C BECK Selection of cases for sympathectomy, demonstration of sympathetomized patients, evaluation of results, management of lymphedema
 F K HICK Vascular accidents associated with coronary occlusion
 H C LUETH Unusual reactions following the use of nitro glycerine
 GEZA DETAKATS Treatment of acute arterial occlusion, operability of hypertension, demonstration of cases
 P J SARMA and H L MISHKIN The treatment of varicose veins and ulcers
 J T REYNOLDS Amputations in peripheral vascular disease

ST ANTHONY DE PADUA HOSPITAL

JOSEPH ZABOARTSKY Operations

ST BERNARD'S HOSPITAL

J T MEYER, E J MEYER and R J MEYER Thyroidectomy
 W G EPSTEIN and M MENNITE Abdominal surgery and differential diagnosis of acute abdominal adhesions

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery
 AUSTIN A HAYDEN Conservation of hearing mastoid and sinus surgery
 ARCHIBALD HOYNE Control of contagion in surgical diseases
 WILLIAM H G LOGAN Oral surgery
 FRANKLIN B MCCARTY Gall bladder surgery
 CHARLES M MCKENNA Undescended testicle
 HUGH MCKENNA Fractures Conservative surgery in diabetic gangrene
 FRANK TREIS Peripheral circulatory diseases

Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES, pathologist, and WILLIAM E ANSPACH, radiologist

ST LUKE'S HOSPITAL

WILLIAM R CUBBINS Arthroplasties of hip joint
 GUY PONTIUS Regional ileitis, local bowel resection for malignancy
 H I MEYER Hashimoto's disease
 H E MOCK Operations

ST MARY OF NAZARETH HOSPITAL

GEORGE MUELLER Regional ileitis
 EDWARD WARSZEWSKI Ulcerative colitis

VETERANS ADMINISTRATION FACILITY

PAUL F BROWN Operations

WESLEY MEMORIAL HOSPITAL

R W MCNEALY, EMORY STRAUSS and F L HUSSEY
 Gastric surgery

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

BENNETT R PARKER Thyroid surgery

COOK COUNTY HOSPITAL

EDWARD J LEWIS Operations

HOLY CROSS HOSPITAL

M J BADZIMIEROWSKI Pre and postoperative treatment of thyroid disease

JACKSON PARK HOSPITAL

HARRY E L TIMM Operations

MERCY HOSPITAL

C L MARTIN Rectal neoplasms and inflammations

MUNICIPAL CONTAGIOUS DISEASE HOSPITAL

ARCHIBALD HOYNE and associates Intubation and tracheotomy, discussion of the advantages and disadvantages of intubation and tracheotomy

PASSAVANT MEMORIAL HOSPITAL

J R BUCHHEIDER, A C IVY and ARTHUR BYFIELD
 Symposium on the biliary tract

MICHAEL REESE HOSPITAL

Dry Clinic

NATHAN CROWN The use and abuse of the injection treatment of hernia, suitable and unsuitable cases, methods
 LEO ZIMMERMAN Surgery of direct inguinal hernia
 RUDOLF SCHINDLER The use of the gastroscope and its value to the surgeon
 SAMUEL GOLDBERG Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections

JAMES PATEJDL Congenital duodenal obstruction in newborn, duodenal diverticuli causing clinical symptoms

Dry Clinic

LEO ZIMMERMAN Diseases of veins
 PHILIP SHAPIRO Recent advances in the treatment of varicose veins
 BERNARD PORTIS Embolism of the peripheral arteries
 SAMUEL PERLOW Surgical measures used in the treatment of peripheral circulatory disturbances, differentiation between arterial and arteriolar spasticity as an aid in the selection of cases for sympathetic ganglionectomy

ST LUKE'S HOSPITAL

WILLIAM HAZLETT Pseudohermaphroditism, carcinoma of breast in a fifteen year old girl

ST MARY OF NAZARETH HOSPITAL

P. DORETTI and T. PLANT Abdominal operative clinic

VETERANS ADMINISTRATION FACILITY

PALL F. BROWN Symposium Stomach surgery

WOMEN AND CHILDREN'S HOSPITAL

Management of Diseases Complicating Surgery

CAROLYN MACDONALD Syphilis

ROSE MENENDIAN Endocrine disorders

RUTH RENTER DARROW Diabetes

Wednesday Morning

AUGUSTANA HOSPITAL

A. T. LUNDGREN EARL GARSIDE R. J. C. OWEN and

J. W. NUZUM Operations

CHICAGO MEMORIAL HOSPITAL

PETER S. CLARK VANCE RAWSON GEORGE LANDAU and

OTTO SAPHIR Call bladder symposium

LEO M. ZIMMERMAN and RICHARD E. HELLER Fundamental problems in the surgical treatment of inguinal hernia modern management of varicose veins

CHILDREN'S MEMORIAL HOSPITAL

A. H. MONTGOMERY J. IRELAND J. GRAHAM W. POTTS

A. DICGS and J. MCSSIL Operations and demonstration of cases

COLUMBUS HOSPITAL

D. A. ORTH and E. NORA Bone and joint tuberculosis peritonitis Rollier treatment

COOK COUNTY HOSPITAL

RAYMOND W. MCNEALY MANUEL LICHTENSTEIN FRED

ERICK TICE RICHARD H. JAFFE and M. J. HUBENY

Symposium Diseases of the gall bladder

RAYMOND W. MCNEALY VICTOR SCHRAGER GEORGE L.

APPELBACH ROGER T. VAUGHAN and MARSHALL

DAVISON Operations

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine 427 S. Honore Street

FANSTON HOSPITAL

Symposium Colon Surgery

L. D. SNORT Diagnosis

E. R. CROWDER Roentgenology

E. L. BENJAMIN Pathology

FREDERICK CHRISTOPHER Surgery

W. R. PARKES Prognosis in malignancy

Dry Clinic

MARUS HOBART Operative treatment of low back pain

JAMES GRIER Common bile duct obstructions

W. K. JENNINGS Prevention of recurrence in femoral

hernia operations

HOLY CROSS HOSPITAL

CHARLES M. McKENNA Cholecystectomy herniorrhaphy

J. F. DYBALSKI Open reduction of fracture of femur

F. KRAFT Hysterectomy perineorrhaphy

F. SALETTE Hysterectomy perineorrhaphy operation for shortening round ligament

M. STRIKOL Appendectomy herniorrhaphy

JACKSON PARK HOSPITAL

ARRIE BAMBERGER Pre and postoperative treatment of surgical cases.

C. C. CLARK and H. HOYT COX Operations

LUTHERAN DEACONESS HOSPITAL

GEORGE O. SOLEM Surgical indications in peptic ulcer

MOTHER CABRINI HOSPITAL

EUGENE J. CHESROW and ALBERT J. CHESROW Operations

E. P. OLIVIERI and V. V. EMANUELE Demonstrations

MOUNT SINAI HOSPITAL

E. I. GREENE Anaerobic hemolytic streptococcus infection (Meleney's disease)

JACOB M. MORA Thyroidectomy in the aged

D. WILLIS Removal of foreign (metallic) bodies from tissues with aid of a new instrument

J. M. GREENE Acute intestinal obstruction

I. TRACE Postoperative pulmonary complications with special reference to massive pulmonary collapse

M. L. ARKIN The surgical diabetic

L. LEIDY and N. I. FOX Medicosurgical discussion

L. FELDMAN Streptococcal bacteremia precipitated by surgical procedures

MUNICIPAL TUBERCULOSIS SANITARIUM

CLEMENT L. MARTIN Anorectal tuberculosis

MAX THOREK Surgery in tuberculous patients

POSTGRADUATE HOSPITAL

EMIL RIES Fissuro-iliac lipomas with backache

PRESBYTERIAN HOSPITAL

V. C. DAVID KELLOGG SPEED C. B. DAVIS Dr. GATE

WOOD E. M. MILLER A. H. MONTGOMERY and associates Operations

MICHAEL REISE HOSPITAL

M. L. PARKER LEE ZIMMERMAN and SAMUEL GOLDBERG Operations

B. PORTIS Thyroid surgery

SAMUEL PERLOW Peripherovascular surgery

A. A. STRAUSS S. STRAUSS and J. PATEJDL Gastrointestinal surgery

RALPH B. BETTMAN and WILLIAM TANNENBAUM Gall bladder operations

Dry Clinic Surgery of the Gall Bladder

SAMUEL SOSKIN Preparation of the liver for surgery

R. A. ARENS The technique of cholecystography

A. M. SERBY S. PORTIS and G. LICHTENSTEIN The evaluation of liver function tests gall bladder diet survey of postoperative results of the gall bladder group

RALPH B. BETTMAN LEO ZIMMERMAN and WILLIAM TANNENBAUM Motion picture and diagrammatic demonstrations The technique of cholecystectomy choledochostomy choledochogastrostomy or enterostomy

RESEARCH AND EDUCATIONAL HOSPITALS

W. H. COLE Thyroidectomy operation for pyloric obstruction

P. J. SARMA and H. L. MISHEIN Clinic on varicose veins Symposium Diseases of the Thyroid

W. H. COLE Pre operative care and postoperative complications

C. B. PUESTOW Use of silk in thyroidectomy

L. SEED and R. BRUNVER Blood pressure studies during thyroidectomy

J. M. MORA Hepatic damage in hyperthyroidism

R W KEETON Cardiac complications of hyperthyroidism
W H COLE Tracheal collapse
JOHN HOWE The thyroid gland as observed at autopsy in patients with diseases other than hyperthyroidism
J H BAILEY Bacteriological studies in the operating room

ST ANNE'S HOSPITAL

THOMAS E MEANY Fractures and tendon transplantations
JOHN L KNAPP and JOHN W KEANE Surgical clinic, demonstration of cases
GEORGE F THOMPSON Surgical clinic, demonstrations

ST ANTHONY DE PADUA HOSPITAL

S F DONLON and H P SULLIVAN Operations and demonstration of cases

ST BERNARD'S HOSPITAL

G M CUSHING The surgical treatment of perforated gastric ulcer

ST LUKE'S HOSPITAL

S W McARTHUR and associates Symposium Surgical conditions of the gall bladder and common duct
E L JENALINSON X ray diagnosis
GRANT LAING Pre operative and postoperative care
S W McARTHUR Operative indications type of procedure with some technical details

U S MARINE HOSPITAL

O E NADEAU Results in hernia surgery
F C LUTTON and R W FLYNN Spinal anesthetics

WESLEY MEMORIAL HOSPITAL

WILLIAM MILLER Review of gall bladder surgery

FRANCES E WILLARD HOSPITAL

VICTOR L SCHRAGER Clinic

WOMEN AND CHILDREN'S HOSPITAL

PEARL M STETLER Abdominal surgery

Wednesday Afternoon

COLUMBUS HOSPITAL

D A ORTH, C J SCHERIBEL and I D NORA Experimental thyrotoxicosis
J L SPITACK Valve operation

MICHAEL REESE HOSPITAL

Symposium

SAMUEL PERLOW Paravertebral alcohol injections for the relief of cardiac pain
LEO ZIMMERMAN and OTTO SAPHIR Benign tumors of the thyroid gland
SAMUEL GOLDBERG Acute mesenteric lymphadenitis, strangulated hernias in premature infants
THOMAS J MERRAR Rectal complications of lympho granuloma inguinale
CASPER EPSTEIN Fractures of the jaws
W L PARKER Carcinoma of the large bowel

ST ANNE'S HOSPITAL

HARRY J DOOLEY Urological clinic and demonstration
JOHN J GEARIN and E F GRAMER Surgical clinic

ST BERNARD'S HOSPITAL

HERMAN DEFEO The medical management of cholecystic diseases
B C GUNSWAY and associates Roentgen studies of gall bladder diseases

S L GOVERNALE Cholecystotomy vs cholecystectomy
CHESTER GUY Pathology of the gall bladder

WESLEY MEMORIAL HOSPITAL

GUY S VAN ALSTYNE Abdominal surgery

FRANCES E WILLARD HOSPITAL

LOUIS F PILZAK Clinic

Thursday Morning

AUGUSTANA HOSPITAL

N M PERCY Operations

CHICAGO MEMORIAL HOSPITAL

PETER S CLARK, LEO M ZIMMERMAN and M L WEINSTEIN Gall bladder surgery

COOK COUNTY HOSPITAL

RICHARD H JAFFE Pathological conference
KARL A MEYER, GEORGE G DAVIS, ALBERT H MONTGOMERY and MAX THOREK Operations
Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs at the Graduate School of Medicine, 427 S Honore Street

EVANGELICAL DEACONESS HOSPITAL

JOHN I PERL Stomach resection

HOI Y CROSS HOSPITAL

J I RANCIS RUZIC Cholecholestomy and dilatation of common duct, vaginal hysterectomy, cholecystectomy
J FRANCIS RUZIC, D DiCRO and WALTER EISEN Resection of superior hypogastric ganglion
D DiCRO Kidney neoplasm
FRANCIS STREYSMAN Varicoceleotomy
JOHN SIMONAITIS Pelvic laparotomy

ILLINOIS MASONIC HOSPITAL

CHARLES DRUECK Pruritus ani—cases due to systemic disturbances Ovarian dysfunction (vicarious pruritus), hypothyroidism, spastic colon, obesity

JACKSON PARK HOSPITAL

GEORGE M LUCAS Operations

LUTHERAN DEACONESS HOSPITAL

JOHN D KOUCKY, G H MAMMEN and GEORGE H SCHROEDER Operations

MERCY HOSPITAL

L D MOORHEAD Symposium Goiter

PASSAVANT MEMORIAL HOSPITAL

PAUL STARR Symposium Diseases of endocrine glands

PRESBYTERIAN HOSPITAL

V C DAVID, C B DAVIS, WILLIAM MILLER and associates Operations
KELLOGG SPEED DR GATEWOOD and A H MONTGOMERY Dry clinics and symposia

MICHAEL REESE HOSPITAL

A A STRAUSS and S STRAUSS Gastro intestinal surgery
D C STRAUSS General surgery
Thyroid Symposium
D C STRAUSS Group study and demonstration of thyroid records, surgical management of hyperthyroidism
S SOSKIN The endocrine disturbance in a thyroid disease
L N KATZ Disturbed physiology of the cardiovascular system in thyroid disease

- M LEV Some clinical aspects of the heart in hyperthyroidism medical management of hyperthyroidism
 A S BOHNING and L N KATZ The electrocardiogram in thyroid disease
 W W HAMBURGER Arrhythmias in thyroid disease
 B PORTIS Outpatient clinic management of hyperthyroidism
 B PORTIS and H ROTH Treatment of hyperthyroidism complicated by pregnancy and syphilis
 R LEVINE Experimental treatment of hyperthyroidism

RESEARCH AND EDUCATIONAL HOSPITALS

- C B PUESTOW Operations Cholecholestomy carcinoma of rectum
 Symposium Gall Bladder Diseases
 C B PUESTOW The effect of cholecystectomy on pressure in the choledochus gall bladder fistulae
 EDMUND FOLEY Differential diagnosis between intrahepatic and extrahepatic jaundice
 W H COLE The rôle of cystic duct obstruction to gall bladder disease
 A HARTUNG The advantage of combining gastro intestinal series with cholecystography

ST ANTHONY DE PADUA HOSPITAL

- F B OLENTINE Operations and demonstration of goiter and abdominal surgery cases

ST JOSEPH'S HOSPITAL

- WILLIAM C BECK Thoracic surgery
 ARCHIBALD HOYNE Control of contagion in surgical diseases
 WILLIAM H G LOGAN Oral surgery
 FRANKLIN B MCCARTY Gall bladder surgery
 CHARLES M MCKENNA Undescended testicle
 HUGH MCKENNA Fractures conservative surgery in dia-betic gangrene
 FRANK THEIS Peripheral circulatory diseases
 Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES pathologist and WILLIAM E ANSPACH radiologist

ST LUKE'S HOSPITAL

- F L McMILLAN Tumors of the colon
 H E MOCK Infected granuloma gall bladder disease
 A R MORROW Acute surgical abdomen
 C E SHANNON Acute and chronic pancreatitis
 JOHN LINDQUIST Appendicitis
 JOHN FRIBBLE Axillary abscess

ST MARY OF NAZARETH HOSPITAL

- J C HILL Pathologic discussion of operative findings
 T LARKOWSKI Symposium Hernias and their repair

VETERANS ADMINISTRATION FACILITY

- PAUL F BROWN Operations

WESLEY MEMORIAL HOSPITAL

- R W McNEALY and associates Surgery of jaundiced patients
 GUY S VAN ALSTYNE Carcinoma of the breast combined surgical and x ray treatment

FRANCES E WILLARD HOSPITAL

- A E STEWART Clinic

WOMEN AND CHILDREN'S HOSPITAL

- PEARL M STETLER and MARIE ORTMAYER Gastrointestinal clinic gastroscopic technique
 ALICE CONKLIN Thyroidectomy
 ESTHER RAHN Repair of ventral hernia

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

- BENNETT R PARKER, LEO M ZIMMERMAN WALTER S PRIEST OTTO SAPHIR and GEORGE M LANDAU Symposium Thyroid disease
 FRANK WRIGHT, ALBERT ZRUNEK LEO M ZIMMERMAN M L WEINSTEIN and OTTO SAPHIR Symposium Blood transfusion

COOK COUNTY HOSPITAL

- RALPH B BETTMAN and EDWARD J LEWIS Operations

HOLY CROSS HOSPITAL

- J FRANCIS RUZIC Biliary tract surgery

MICHAEL REESE HOSPITAL

- Symposium Gastro-Intestinal Surgery
 LEON BLOCH The medical treatment of ulcerative colitis
 A A STRAUSS The surgical management of ulcerative colitis
 S STRAUSS The use of ileostomy in ulcerative colitis and carcinoma of the colon
 OTTO SAPHIR Pathology of ulcerative colitis Discussion
 R ARENS X ray diagnosis of ulcerative colitis and peptic ulcer Discussion
 A A STRAUSS and H F BINSWANGER Medical and surgical treatment of terminal ileitis

RESEARCH AND EDUCATIONAL HOSPITALS

- Symposium Diseases of the Gastro-Intestinal Tract
 GEORGE MILLES Pathology of carcinoma of stomach
 W H COLE Total gastrectomy
 T J WACHOWSKI X ray diagnosis of carcinoma of stomach
 C L BIRCH Anemia associated with total gastrectomy
 M H STREICHER Diagnosis of carcinoma of the rectum
 C B PUESTOW Surgical treatment of carcinoma of the rectum
 BERNARD PORTIS Surgical treatment of complicated duodenal ulcers
 F L McMILLAN Regional ileitis
 J L SPIVACK Tubo-ovarian stoma with particular reference to gastrostomy
 H O WERNICKE The injection treatment of hernias.

ST ANTHONY DE PADUA HOSPITAL

- W H BRADLEY Operations

ST BERNARD'S HOSPITAL

- W S HECTOR and S S DUBOVY Imperforate anus with atresia of large bowel

ST LUKE'S HOSPITAL

- H E JONES Reconstruction of the common duct.
 LEE STROHL Appendicitis

ST MARY OF NAZARETH HOSPITAL

- A PARTIPIO Aseptic gastro-intestinal anastomosis
 P CZWALINSKI Surgical incisions
 F TENOZAR Abdominal operations

WESLEY MEMORIAL HOSPITAL

- E B PERRY and H E E BARNARD Abdominal surgery

FRANCES E WILLARD HOSPITAL

- OTIS M WALTER Clinic

WOMEN AND CHILDREN'S HOSPITAL

- LEWIS GRYOTAS Cholecystectomy

*Friday Morning***ALBERT MERRITT BILLINGS HOSPITAL**

H LIVINGSTONE Anesthesia and the circulation
 N ROOME, H WILSON H N HAPKINS and D B
 PHEMISTER Causes and treatment of surgical shock
 W E ADAMS Intrathoracic operation and the circulation

COLUMBUS HOSPITAL

M J SEIFERT and F A O'MALLEY Gastro intestinal sur-
 gery

COOK COUNTY HOSPITAL

DR GATEWOOD Children's surgery
 RALPH C SULLIVAN, VERNON C DAVID, HARRY JACKSON
 and FRANK J JIRKA Operations
 Members of the surgical staff will give demonstrations
 in surgical technique upon cadavers and dogs in the labo-
 ratories of the Graduate School of Medicine, 427 S. Honore
 Street

HOLY CROSS HOSPITAL

FRANK FRAIDER and NICHOLAS PAVLETIC Hysterectomy,
 cesarean section, cholecystectomy
 STEPHEN BIEZIS Cholecystectomy, hysterectomy, repair
 of incisional hernia
 FELIX WINSKUNAS Inguinal herniorrhaphy
 JAMES GALLAGHER Cholecystectomy
 WILLIAM REILLY Cholecystectomy and appendectomy
 M J BADZMIEROWSKI and H IRACE Hysterectomy

ILLINOIS MASONIC HOSPITAL

CHARLES H PARKES, CARL F STEINHOFF and WALTER C
 BORNEMEYER Surgical diabetes—organization of the
 service for the care of the surgical diabetic where an
 intimate relationship exists between the surgeon and the
 internist which is greater than that of a consultation,
 review of cases on service for past ten years, presentation
 of treatment involved in surgical diabetes protomine
 insulin, anesthesia, operative and postoperative cases,
 lower extremity

JOHN R HARGER and JOHN H GILMORE Gall bladder
 surgery—history building Personal history in detail,
 laboratory findings and practical values of various tests,
 x ray, development to date in this diagnostic field, dem-
 onstration of operative technique with use of peridural
 route for anesthesia in the cases, discussion of advantages
 of peridural anesthesia over spinal and lessening of haz-
 ard, greater satisfaction than with any type of general

JACKSON PARK HOSPITAL

A BAMBERGER, H H COY and C CLARK Operations

LUTHERAN DEACONESS HOSPITAL

JOHN D KOLCKY, G H MAMMEN and GEORGE H
 SCHROEDER Operations
 GEORGE O SOLEM Surgical indications in peptic ulcer

MOUNT SINAI HOSPITAL

A A STRAUSS, S F STRAUSS and B SAYRE Operations
 M LEWISON Surgery in cardiovascular diseases
 H J ISAACS Coronary disease simulating acute abdomi-
 nal catastrophes
 E B FRELICH Surgery in tuberculosis
 I DAVIDSON Clinical pathological conference

PASSAVANT MEMORIAL HOSPITAL

SAMUEL J FOGELSON Experimental surgical problems

POSTGRADUATE HOSPITAL

L ZIMMERMAN Varicose veins and their complications

PRESBYTERIAN HOSPITAL

V C DAVID, KELLOGG SPEED, C B DAVIS, DR GATE-
 WOOD, WILLIAM MILLER and A H MONTGOMERY
 Operations

MICHAEL REISE HOSPITAL

J PATEJDL, P SHAPIRO, R CRAWFORD, B PORTIS, S
 GOLDBERG, M L PARKER and LEO ZIMMERMAN Oper-
 ations

RESEARCH AND EDUCATIONAL HOSPITALS

R B MALCOLM Operative clinic Neck dissection, carci-
 noma of breast, surgical pathology of breast tumors
 Clinical Demonstration
 T J WACHOWSKI X-ray treatment of carcinoma of the
 breast
 ARRIE BAMBERGER Ewing tumor with case report
 S R ROSENTHAL The toxin and antitoxin of burns
 W H COLE Acute pancreatitis

ST ANTHONY DE PADUA HOSPITAL

J J SPRAFKA Abdominal surgery and demonstration

ST ELIZABETH'S HOSPITAL

E D KALZELAGE Thyroid disease

ST LUKE'S HOSPITAL

MEDICAL BOARD Staff clinic, including papers, discus-
 sion and pathological demonstrations

WESLEY MEMORIAL HOSPITAL

EARL LATIMER Unusual breast tumors

*Friday Afternoon***COOK COUNTY HOSPITAL**

J G FROST Operations
 SUMNER L KOCH Surgery of the hand
 E H WARSZEWSKI Operations

HOLY CROSS HOSPITAL

CHARLES GALANTI Osteogenic sarcoma
 EMIL WEISS Splenomegaly

JACKSON PARK HOSPITAL

HARRY E L TIMM Operations

MOUNT SINAI HOSPITAL

I DAVIDSON Differential diagnosis of infectious mono-
 nucleosis simulating surgical conditions, demonstration
 of technique

ST BERNARD'S HOSPITAL

J M MAHONEY Infective granuloma of the cecum simu-
 lating a neoplasm, case demonstration

ST ELIZABETH'S HOSPITAL

J K NARAT Pre and postoperative intravenous admin-
 istration of fat emulsion

*Days to be Announced***COOK COUNTY HOSPITAL**

VICTOR L SCHRAGER Symposium Appendicitis
 SUMNER L KOCH Symposium Hand infections
 HARRY JACKSON Symposium Skull fractures
 EDWIN M MILLER Symposium Children's surgery
 FREDERICK G DYAS Symposium Peritonitis
 MARSHALL DAVISON Symposium Diseases of the thyroid
 VERNON C DAVID Symposium Surgery of large bowel

GYNECOLOGY AND OBSTETRICS

Monday Afternoon

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR and staff Motion picture demonstration of cesarean section

COOK COUNTY HOSPITAL

FREDERICK H FALLS Operations

A F LASH Puerperal sepsis ward walk

HOLY CROSS HOSPITAL

PAUL LAWLER Application of obstetrical forceps (manikin demonstration)

ILLINOIS MASONIC HOSPITAL

HAROLD W. MILLER and WALTER BORNEMEIER Ovarian cysts uterine fibroids Dry clinic for demonstration of cysts and general discussion operation during which use and value of peritoneoscope will be demonstrated

F O BOWLE and BEULAH WALLIN Cesarean section Indications comparison of results in different types demonstration of operative technique of low cesarean section

ST BERNARD'S HOSPITAL

E A RACH and F J STUCKER Cesarean section

ST LUKE'S HOSPITAL

OBSTETRICAL STAFF Ward walk

WOMEN AND CHILDREN'S HOSPITAL

ANNIE E BLOUNT Operations

Tuesday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR WILLIAM J DIECKMANN M EDWARD DAVIS H C HESSELTINE and staff Cesarean section Motion picture demonstration of colpocleisis operation

COOK COUNTY HOSPITAL

CAREY CULBERTSON and A E KANTER Operations

D S HILLIS Treatment of abortion ward walk

PRESBYTERIAN HOSPITAL

N S HEANEY CAREY CULBERTSON A E KANTER E D ALLEN and H BOYSEN Operations

MICHAEL REESE HOSPITAL

J L BAER J E LACKNER WILLIAM RUBOVITS I F STEIN and RALPH REIS Operations

JOSEPH L BAER Ward rounds

WILLIAM RUBOVITS Ward rounds

ST LUKE'S HOSPITAL

H O JONES and associates Demonstration clinic

W T CARLISLE Endometrial studies

ELGENE CARY Treatment of occiput posterior

WESLEY MEMORIAL HOSPITAL

MARE COLDSBINE and associates Uterine bleeding

FRANCES E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

MARY EDITH WILLIAMS Removal of abdominal tumors

OTILLIE ZELEVNY Electrocoagulation of the cervix uteri

Tuesday Afternoon

CHICAGO LYING-IN HOSPITAL

WILLIAM J DIECKMANN and staff Dry clinic Eclampsia Motion picture demonstration of forceps delivery

COOK COUNTY HOSPITAL

J P GREENHILL Operations

L RUDOLPH and J H BLOOMFIELD Symposium The toxemias of pregnancy

PASSAUNT MEMORIAL HOSPITAL

ARTHUR H CURTIS and GEORGE H GARDNER Operative and demonstration clinic

ST BERNARD'S HOSPITAL

S S SCHOCHET Fibroids

ST ELIZABETH'S HOSPITAL

J R LAVIER Cesarean section

ST MARY OF NAZARETH HOSPITAL

L KOZAKIEWICZ and M UZANSKI Toxemias of pregnancy

FRANCES E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

FLOISE PARSONS Vaginal hysterectomy vaginal sterilization ligation of tubes per vaginal route

Wednesday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR WILLIAM J DIECKMANN M EDWARD DAVIS H C HESSELTINE and staff Operations and demonstration of cases

COOK COUNTY HOSPITAL

C W BARRETT Operations

J F FITZGERALD Heart disease in pregnancy ward walk

EVANGELICAL DEACONESS HOSPITAL

A J SCHOENBERG Hysterectomy

JACKSON PARK HOSPITAL

CHARLES J GREENE LOUIS H STERN W J NIXON DAVIS JR and NORMAN ZOLLA Treatment of contracted pelvis by cesarean section version and forceps

PASSAUNT MEMORIAL HOSPITAL

GEORGE H GARDNER and ARTHUR H CURTIS Gynecological pathology—demonstration and conference

PRESBYTERIAN HOSPITAL

N S HEANEY CAREY CULBERTSON A E KANTER E D ALLEN and H BOYSEN Demonstration of cases

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS Eclampsogenic toxemia low cervical cesarean section under local anesthesia

W H BROWNE Progesterin in the treatment of abortion

G H REZER Modification of the Friedmann reaction

MICHAEL REESE HOSPITAL

JOSEPH L BAER Ward rounds

WILLIAM RUBOVITS Ward rounds

Dry Clinic

- JOSEPH L. BAER Shifting trends in the treatment of prolapse of the uterus
 JULIUS E. LACANER Recent investigations in the action of progesterone
 WILLIAM RUBOVITS Postoperative vaginal antiseptics
 IRVING F. STEIN Evaluation of the "safe period"
 RALPH A. REIS Mammography
 LESTER E. FRANKENTHAL, Jr. Treatment of vulvovaginitis
 MICHAEL L. LEVENTHAL The Manchester operation for the cure of cystocele and prolapse
 HENRY BUXBAUM The role of spermatotoxin in temporary sterility
 A. F. LASH Early diagnosis of carcinoma of the uterus
 E. J. DECOSTA The use of progesterone in the prevention of habitual abortion
 ALFRED J. KOBAK Maternal mortality in Chicago
 HERMAN STRAUSS Routine palpation of the ureters during hysterectomy

ST LUKE'S HOSPITAL

- GEORGE C. FINOLA Blood calcium studies during pregnancy
 JAMES A. GOUGH Chorionepithelioma

WASHINGTON BOULEVARD HOSPITAL

- PAUL C. FOX Sterility

WESLEY MEMORIAL HOSPITAL

- CHARLES B. REED, WILLIAM B. SERBIN and G. C. RICHARDSON Moving picture demonstration of low forceps, breech extraction with forceps on aftercoming head spontaneous breech—manual aid

WOMEN AND CHILDREN'S HOSPITAL

- FLORENCE HARK Prenatal care with reference to the baby
 RUTH R. DARROW Treatment of icterus gravis
 BERTHA VAN HOOSER Maternity mortality

Wednesday Afternoon**CHICAGO LYING IN HOSPITAL**

- H. C. HESSELTINE and staff Nonconvulsive toxemia of pregnancy Motion picture of birth injury

CHICAGO MEMORIAL HOSPITAL

- PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, B. E. TUCKER and WALTER WIBORG Plastic repair
 JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON Cesarean section

COOK COUNTY HOSPITAL

- W. T. CARLISLE Operations
 D. S. HILLIS J. H. BLOOMFIELD and A. F. LASH Symposium Cesarean section

RESEARCH AND EDUCATIONAL HOSPITALS

- FREDERICK H. FALLS and staff Operations Symposium Gynecological tumors
 FREDERICK H. FALLS Vulva carcinoma, demonstration of cases, vulvectomy, under local anesthesia
 R. A. LIFVENDAL Solid tumors of ovary, removal of ovarian cyst
 H. H. HILL Early carcinoma of cervix

WOMEN AND CHILDREN'S HOSPITAL

- CONSTANCE O'BRIEN Operations
 BERTHA VAN HOOSER and MAUDE HALL WINNETT Anesthesia in obstetrics
 BEATRICE E. TUCKER Parasacral anesthesia

Thursday Morning**CHICAGO LYING IN HOSPITAL**

- FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff Cesarean section
 Motion picture demonstration of blood transfusion

CHICAGO MEMORIAL HOSPITAL

- PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, BEATRICE E. TUCKER and WALTER WIBORG Symposium The treatment of prolapse of the uterus, cystocele and rectocele at various ages
 JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON Indications and technique for cesarean section, nerve block in obstetrics

COOK COUNTY HOSPITAL

- EGON W. FISCHMANN Operations
 J. E. FITZGERALD and L. RUDOLPH Symposium Ectopic pregnancy, its diagnosis and treatment

MOUNT SINAI HOSPITAL

- A. H. KLAUANS Endometriosis
 A. E. KANTER Masculinizing tumors of ovary
 A. F. LASH Pelvic infections
 A. H. E. GOLDFINE, C. NEWBERGER, H. BUXBAUM and associates Symposium Obstetrical hemorrhages
 L. RUDOLPH Physiological and clinical aspect of occipito-posterior position
 A. ARNIN, I. A. RABENS and R. GORDON Dry clinic

PRESBYTERIAN HOSPITAL

- N. S. HEANEY, CAREY CULBERTSON, A. C. KANTER, E. D. ALLEN and H. BOYSEN Operations

MICHAEL REESE HOSPITAL

- JOSEPH L. BAER Ward rounds
 WILLIAM RUBOVITS Ward rounds

ST ANTHONY DE PADUA HOSPITAL

- M. A. WEISSKOPF Operations

ST LUKE'S HOSPITAL

- H. K. GIBSON The late toxemias of pregnancy

WESLEY MEMORIAL HOSPITAL

- MARA GOLDSTEIN and associates Vaginal plastics

Thursday Afternoon**CHICAGO LYING IN HOSPITAL**

- M. EDWARD DAVIS and staff Placenta previa abruptio placenta Motion picture of postpartum hemorrhage

COOK COUNTY HOSPITAL

- FREDERICK H. FALLS Operations
 J. H. BLOOMFIELD and D. S. HILLIS Symposium Late hemorrhages of pregnancy

PASSAVANT MEMORIAL HOSPITAL

- ARTHUR H. CURTIS and GEORGE H. GARDNER Operative and demonstration clinic

ST MARY OF NAZARETH HOSPITAL

- H. LITTLE Ovarian tumors

Friday Morning**CHICAGO LYING-IN HOSPITAL**

- FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff Cesarean section

COOK COUNTY HOSPITAL

A E KANTER and CAREY CULBERTSON Operations
A F LASH Toxemias of pregnancy ward walk

PRESBYTERIAN HOSPITAL

N S HEANEY CAREY CULBERTSON A E KANTER E D
ALLEN and H BOYSEN Operations

MICHAEL REESE HOSPITAL

J L BAER J E LACKNER WILLIAM RUBOVITS I F
STEIN and RALPH REIS Operations
JOSEPH L BAER Ward rounds
WILLIAM RUBOVITS Ward rounds

ST BERNARD'S HOSPITAL

J B HAEBERLIN Hysterectomy and its indications

ST LUKE'S HOSPITAL

JAMES E FITZGERALD Heart disease in pregnancy

WESLEY MEMORIAL HOSPITAL

CHARLES B REED WILLIAM B SERBIN and G C RICH
ARDSON Ablatio placenta placenta previa

WOMEN AND CHILDREN'S HOSPITAL

BERTHA VAN HOOSSEN and MAUDE HALL WENNET Surg
ical cases complicating obstetrics

Friday Afternoon

CHICAGO LYING-IN HOSPITAL

FRED L ADAIR and staff Dry clinic Motion picture
demonstration of episiotomy

COOK COUNTY HOSPITAL

CAREY CULBERTSON Operations

L RUDOLPH Symposium Prolonged labor, constriction
ring dystocia

MERCY HOSPITAL

H E SCHMITZ and associates Symposium on operative
gynecology

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS and staff Symposium Gynecological
plastic operations with special reference to the use of
local anesthesia
FREDERICK H FALLS Vaginal hysterectomy for proci
dentia under local anesthesia
W J SUMMERVILLE Anterior colporrhaphy and interpo
tion operation under local anesthesia
WILLIAM H BROWNE Sturmdorf Kelly incontinence op
eration and perineorrhaphy under local anesthesia

WOMEN AND CHILDREN'S HOSPITAL

CATHERINE TRUE Abdominal gynecological cases
ELOISE PARSONS Treatment of sterility treatment of
eroded cervix by cautery lipiodol visualization of uterus
and tubes

Days to be Announced

COOK COUNTY HOSPITAL

J P GREENHILL C W BARRETT W T CARLISLE EGON
W FISCHMAN FREDERICK H FALLS A E KANTER
and CAREY CULBERTSON Symposium on fibroids

HENROTIN HOSPITAL

EDWARD L CORNELL Operations and demonstration of
cases
CHAN'ING W BARRETT and LEE STONE Operations and
demonstration of cases

ORTHOPEDIC SURGERY

Monday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

H B THOMAS F W HARK and C N LAMBERT Sym
posium Tenodesis Operations and demonstration of
cases tendon transplantations

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Spondylo
listhesis aseptic necrosis of the head of the femur

Tuesday Morning

CHILDREN'S MEMORIAL HOSPITAL

F CHANDLER F SEIDLER C PEASE and J NORCROSS
Operations and demonstration of cases

COLUMBUS HOSPITAL

E H SLOTT and I E SLOTT Sciatica

COOK COUNTY HOSPITAL

ARTHUR CONLEY Operations and symposium with demon
stration of cases blind pegging of hip for fracture of neck
of femur using Kirschner wire and Smith Petersen nail
problems in diagnosis of bone tumors painful back in
medicolegal cases persistent dizziness following head
injuries fractures in and about the ankle
MARCUS H HOBART Operation Removal of internal semi
lunar cartilage Demonstration of cases Recurrent dis

locations of shoulder internal derangement of knee
joint spinal fusions, low back pain acquired disloca
tions of hip following scarlet fever syndactylism.

PRESBYTERIAN HOSPITAL

E J BERKHEISER Dry clinic and demonstration of cases

MICHAEL REESE HOSPITAL

PHILIP LEWIN DANIEL LEVINTHAL, CHARLES PEASE
F GLASSMAN SIDNEY SIDEMAN JEROME G FINDER and
I WOLIN Operations

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Chordotomy
for chorio-athetosis spina bifida

Tuesday Afternoon

MOUNT SINAI HOSPITAL

C JACOBS Orthopedic demonstrations
L MILLER Visualization of joints
J FINDER Giant cell tumor of bone
F GLASSMAN Nonunion of neck of femur

ST LUKE'S HOSPITAL

H A SOFIELD Fracture of the neck of the femur treated
by steel pin method of fixation Lantern slides cases
E W RYERSON Injuries and anomalies of the spine
R O RITTER Fractures and infantile paralysis

WESLEY MEMORIAL HOSPITAL

F M JANSEY, H KELIKIAN and O H HORRALL Bone and joint surgery

Wednesday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VRIJAL Indications for surgical treatment of arthritis

MUNICIPAL TUBERCULOSIS SANITARIUM

E J BERKHEISER Bone tuberculosis

ST BERNARD'S HOSPITAL

L B DONKLE and M E CREIGHTON Fractures of the shaft of the femur

ST LUKE'S HOSPITAL

E W RYERSON and associates Operations

WESLEY MEMORIAL HOSPITAL

PHILIP H KRFUSCHER and associates Bone and joint surgery, knee injuries

Wednesday Afternoon

EVANSTON HOSPITAL

J L PORTER and R C IONERGAN Low back disorders

MERCY HOSPITAL

J D CLARIDGE and associates Problems in orthopedic and traumatic surgery

PASSAVANT MEMORIAL HOSPITAL

EMIL HAUSER and associates Surgery of the knee and foot—demonstration of cases and lantern slides Total tendon transplant for slipping patella, injuries of the external semilunar cartilage, loose body, the result of a semilunar cartilage injury, manipulative correction of deformity tendon transplant as a routine procedure to triple arthrodesis of the paralytic foot, reconstruction operation for hallux valgus

PRESBYTERIAN HOSPITAL

E J BERKHEISER, KELLOGG SPEED and D RIDER Operations

MICHAEL REESE HOSPITAL

PHILIP LEWIN Fracture problems, new approach for arthrodesis of knee joint, discussion of bone tumors, motion picture demonstration of manipulative surgery
SIDNEY SIDEMAN Rice bodies in tendon sheath of the hand, Hole stabilization of the foot, spastic paralysis, roentgenologic library of the hip joint, fusion operation in tuberculosis of the knee joint, bunion operation, multiple cartilaginous exostosis

DANIEL H LEVINTHAL and IRVING WOLIN Tendon transplantation in poliomyelitis, spastic paralysis, recurrent dislocation of shoulder flat feet, demonstration of arthroplasties of the knee, hip and elbow, knee joint surgery

CHARLES PEASE Acute transverse atrophy of bone, traumatic rupture of intervertebral disc, reduction of compression fracture of spine, osteochondromatosis of the elbows

JEROME G FINDER Chondromyxosarcoma, two cases, flexorplasty of the thumb for paralytic opposens pollicis osteochondroma of the tibia, McBride bunion plasty, unusual bone tumor (?) of femur, key operation for soft corns, spastic paralysis—bilateral adductor

tenotomy and obturator nerve neurectomy, case with unusual deformities

FRANK GLASSMAN Fracture and dislocation of shoulder, supracondylar fracture of the humerus, fracture of the neck of the femur, complete fracture of the tibia and fibula, removal of the head of the radius, three cases, osteoma of the femur, demonstration of various types of fractures and treatment

ST ANTHONY DE PADUA HOSPITAL

THOMAS DWYER New bone biopsy trephine, pathological specimens

ST LUKE'S HOSPITAL

H B THOMAS, FRED HARK and CLAUDE LAMBERT Whitman's reconstruction of the hip, good range of motion, Vollmann's contracture, a plea for early treatment, echinococcus cyst of the os ilium, chronic arthritis joints, arthroplasty

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Bone and Joint Surgery

E L COMPERE Leg lengthening operation, technique and results, spinal fusion in the correction of scoliosis

C H HATCHER The pathology and treatment of tuberculous arthritis, studies in the rate of skeletal growth and equalization of limb length

H N HARKINS Bone graft for ununited fracture

P C BUCY and R B CROWARD Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis

C B HUGGINS Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton

COOK COUNTY HOSPITAL

DANIEL H LEVINTHAL Bone graft surgery for nonunion, stabilization and benign bone tumors Motion picture demonstration Surgical treatment of spastic paralysis, surgical treatment of residual paralysis following poliomyelitis

PHILIP H KREUSCHER Nicola operation, semilunar cartilage derangement, spinal grafts, new operation for hip fusion, new operation for knee fusion

PHILIP LEWIN Tunnel skin graft over os calcis, spondylolisthesis, stabilization of paralytic varus foot, arthrodesis of ankle joint, hallux varus, tuberculous spine, fusion, infantile paralysis, low back pain with "sciatica"

FRANK G MURPHY Skin grafts for old wounds of leg, unusual bone tumors, fracture into ankle joint, mal union of Colles' fracture, tuberculosis of cuneiform bone, scar contracture of forearm, skin graft

ILLINOIS MASONIC HOSPITAL

CHARLES N PEASE and EDGAR WHITE Tuberculosis of the knee, fractures about the elbow in children, reduction of fractures of the spine, traumatic rupture of the intervertebral disc

MICHAEL REESE HOSPITAL

PHILIP LEWIN, DANIEL LEVINTHAL, CHARLES PEASE, F GLASSMAN, I WOLIN, SIDNEY SIDEMAN and JEPOME G FINDER Operations

ST BERNARD'S HOSPITAL

S L GOVERNALE Pseudomuscular dystrophy, case demonstration

J G FROST Metastatic hypernephroid carcinoma of the femur

R S WESTLINE and E L ARENSDORF Fractures of the wrist joint

ST LUKE'S HOSPITAL

F W RYERSON and associates Clinic

ST MARY OF NAZARETH HOSPITAL

L CZAJA Clinic

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Operations

Thursday Afternoon

COOK COUNTY HOSPITAL

E J BERKHEISER Operations and demonstration of cases—spondylolisthesis anterior poliomyelitis, arthrodesis and tendon transplantation

PRESBYTERIAN HOSPITAL

E J BERKHEISER and D RIDER Operations

RESEARCH AND EDUCATIONAL HOSPITALS

H B THOMAS F W HARK and C N LAMBERT Operation Shelving of a congenital dislocated hip Demonstration of patients with closed reduction open reduction and shelving of congenital dislocation

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Bone tumors

Friday Morning

LUTHERAN DEACONESS HOSPITAL

I MIL VRTIAK Indications for surgical treatment of arthritis

PRESBYTERIAN HOSPITAL

E J BERKHEISER KELLOGG SPEED and D RIDER Operations

ST BERNARD'S HOSPITAL

CHESTER C GUY Surgical pathology of bone tumors

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Maggot treatment of osteomyelitis

Friday Afternoon

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Knee fusion giant cell tumor of spine cyst of femur

GENITO-URINARY SURGERY

Monday Afternoon

COLUMBUS HOSPITAL

WILLIAM GEHL FRANK L CHENOWETH H E DAVIS and I F VOLINI Rectoscopy for bladder carcinoma

Tuesday Morning

MOUNT SINAI HOSPITAL

H ROLNICK H SOLOWAY and E HIRSCH Symposium Tumors of the kidney

PASSAVANT MEMORIAL HOSPITAL

L L VESEEN V D LESPINASSE HARRY CULVER and FRED LIEBERTHAL Symposium Tuberculosis of the urinary tract

PRESBYTERIAN HOSPITAL

HERMAN L KRETSCHMER ROBERT HERBST and associates Operations

MICHAEL REESE HOSPITAL

I KOLL J EISENSTAEDT H ROLNICK I SHAPIRO J GROVE F LIEBERTHAL and A E JONES Symposium Carcinoma of the urinary bladder

ST JOSEPH'S HOSPITAL

CHARLES M McKENNA Undescended testicle

ST MARY OF NAZARETH HOSPITAL

J WELFELD Urologic clinic Malignancy of tumors of the bladder in children

WESLEY MEMORIAL HOSPITAL

V D LESPINASSE and associates Clinic Presentation of cases

WOMEN AND CHILDREN'S HOSPITAL

MARIE ORTMAYER and PEARL M STETLER Clinic

Tuesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

C M McKENNA R D HERROLD and staff Operations and demonstrations Experimental and clinical studies on various types of urinary antiseptics anomalies with special reference to undescended testicle and hypospadias

ST ANTHONY DE PADUA HOSPITAL

O J JIRSA Prostatic management carcinoma of bladder pyelography

Wednesday Morning

CHICAGO MEMORIAL HOSPITAL

J WILLIAM PARKER and JOHN P O'NEIL Operations

COOK COUNTY HOSPITAL

HARRY CULVER L L VESEEN CHARLES McKENNA and HARRY ROLNICK Operations

GARFIELD PARK HOSPITAL

VINCENT J O'CONNOR C C SAEHLHOF and associates More recent advances in infections in the urinary tract.

MERCY HOSPITAL

H E LANDES Symposium Transurethral resection J E LAIBE and associates Kidney anomalies treatment of neoplasms of the urinary tract.

MUNICIPAL TUBERCULOSIS SANITARIUM

DORRIN RUDNICK Tuberculosis of the urinary tract

PRESBYTERIAN HOSPITAL

HERMAN L KRETSCHMER ROBERT HERBST and associates Operations

MICHAEL REESE HOSPITAL

I KOLL J EISENSTAEDT H ROLNICK I SHAPIRO J GROVE F LIEBERTHAL and A E JONES Operations

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL

- J WILLIAM PARKER, JOHN P O'NEIL, E J STIEGLITZ,
D G BRUNJES, OTTO SAPHIR and GEORGE M LANDAU
Symposium Kidney infections
M L WEINSTEIN, J WILLIAM PARKER and JOHN P
O'NEIL Transurethral resection of the prostate
R A MLENDY, J WILLIAM PARKER, JOHN P O'NEIL and
OTTO SAPHIR Tuberculosis of urinary tract in males

EVANSTON HOSPITAL

- J I FARRELL Undescended testicles

ST ANNE'S HOSPITAL

- HARRY J DOOLEY Urological clinic, demonstrations

ST BERNARD'S HOSPITAL

- ANDREW SULLIVAN Operations

ST ELIZABETH'S HOSPITAL

- T G McDUGALL Carcinoma of the bladder

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL

- HERMAN L KRETSCHMER and K BARBER Operations

COOK COUNTY HOSPITAL

- HARRY CULVER and CHARLES MCKENNA Symposium
Chronic bladder neck obstructions in the male

ILLINOIS MASONIC HOSPITAL

- EDWARD W WHITE, ROBERT H HAYES and JOHN H
GILMORE Renal tuberculosis Avenues of transmission,
discussion of the pathogenesis and morbidity, primary
foci and complicating factors in relation to general
tuberculosis, roentgenological aspects, concerning pro-
static resection

- CLARENCE C SAEIHOFF and JOHN H GILMORE Carcinoma
of bladder—diagnosis, type of treatment and approach,
result and cases, renal calculi—multiple stone in redupli-
cated pelvis diagnosis treatment by heminephrectomy,
operative cases, malignancy of prostate gland—diagno-
sis, method of immediate relief for obstructive symptoms,
postoperative radiation therapy and results cases,
roentgenological advances in urologic diagnosis

JACKSON PARK HOSPITAL

- WILLIAM Y OVNER Transurethral prostatic resection com-
pared to other types of prostatic surgery

PRESBYTERIAN HOSPITAL

- HERMAN L KRETSCHMER, ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

- I KOLL, J FISENSTAEDT, H ROLNICK, I SHAPIRO, J
GROVE, F LIEBERTHAL and A E JONES Operations

ST JOSEPH'S HOSPITAL

- CHARLES M MCKENNA Undescended testicle

ST LUKE'S HOSPITAL

- L E SMITH, HARRY CULVER and associates Genito-
urinary clinic Urinary calculi

VETERANS ADMINISTRATION FACILITY

- T G McDUGALL Carcinoma of the bladder

WASHINGTON BOULEVARD HOSPITAL

- VINCENT J O'CONNOR Plastic on renal pelvis for hy-
dronephrosis, review of various types of hydronephrosis
with exhibition of films and pathologic specimens

WESLEY MEMORIAL HOSPITAL

- V D LESPINASSE and associates Clinic

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

- PAUL MÖRF Nephrolithotomy

ILLINOIS MASONIC HOSPITAL

- C OTIS RITCH Nephrectomy, transurethral prostatic
resection, urological clinic Anomalies of upper urinary
tract, bilateral and unilateral complete reduplication of
kidneys and ureters, incomplete reduplication of kidneys
and ureters, bifid pelvis ureteral buds, renal tuberculosis

PRESBYTERIAN HOSPITAL

- HERMAN L KRETSCHMER, ROBERT HERBST and associates
Dry clinic

VETERANS ADMINISTRATION FACILITY

- T G McDUGALL Perineal prostatectomy

Days to be Announced

COOK COUNTY HOSPITAL

- L L VESEEN and HARRY ROLNICK Symposium Pyo-
genic infections of the upper urinary tract

THORACIC SURGERY

Monday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM

Collapse Therapy Clinic
23 W Wacker Drive

- STAFF Demonstration of collapse therapy measures on
ambulatory patients, discussion of indications, results,
complications and technique

Tuesday Morning

ALBERT MERFITT BILLINGS HOSPITAL

- W E ADAMS and associates Experimental esophageal
surgery

COLUMBUS HOSPITAL

- R M DAVISON, C VOLINI, M JOANNIDES, D ORTH and
G MUELLER Symposium on tuberculosis Thoracic
surgery, pneumothorax treatment including climato-
therapy

COOK COUNTY HOSPITAL

- JOHN B O'DONOGHUE and ROBERT LEE Treatment of
empyema, ward walk and presentation of cases

RESEARCH AND EDUCATIONAL HOSPITALS

- WILLARD VA HAZEL Operations with demonstration of
cases

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery

VETERANS ADMINISTRATION FACILITY

JEROME R HEAD New type of thoracoplasty chest surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL

RALPH B BETTMAN Operations

PRESBYTERIAN HOSPITAL

JOHN DORSEY Dry clinic and demonstration

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S LEVINSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H HOLINGER Bronchogenic aspects

WILLARD VAN HAZEL Surgical consideration demonstration of cases and specimens surgical treatment of mediastinal tumors

T J WACHOWSKI Roentgenological consideration of mediastinal tumors

M JOANNIDES Collapse therapy of pulmonary tuberculosis

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

W E ADAMS and associates Intrathoracic neoplasms

EVANSTON HOSPITAL

JEROME R HEAD Indications for lobectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON Thoracoplasty
Collapse Therapy Clinic
23 N Wacker Drive

STAFF Phrenic artificial pneumothorax pneumoperitoneum

ST BERNARD'S HOSPITAL

R J DREYER The rational treatment of empyema demonstration of cases

S L GOVERNALL and F F FIORE Congenital cyst of the lung demonstration of cases

Wednesday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM

M JOANNIDES Phrenic surgery intrapleural pneumolysis

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

ST LUKE'S HOSPITAL

WILLARD VAN HAZEL Chest surgery demonstration of cases

PAUL HOLINGER Bronchogenic aspect of chest surgery

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

W E ADAMS and associates Operations

ILLINOIS MASONIC HOSPITAL

MENAS JOANNIDES Phrenic neurectomy phrenic crush scalenotomy artificial pneumoperitoneum cleothorax

Dry clinic Cleothorax Indications technique and complications advantages of artificial pneumoperitoneum as an adjunct to phrenic neurectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON Thoracoplasty pneumolysis

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery

Thursday Afternoon

COOK COUNTY HOSPITAL

RALPH B BETTMAN Operations

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracic surgery

ST BERNARD'S HOSPITAL

A H MONTGOMERY and R E CUMMINGS Pericarditis with effusion demonstration of case

Friday Morning

ALBERT MERRITT BILLINGS HOSPITAL

W E ADAMS and associates Intrathoracic operations and the circulation (experimental and case presentation)

MUNICIPAL TUBERCULOSIS SANITARIUM

(Collapse Therapy Clinic, 23 N Wacker Drive)

STAFF Pneumolysis cleothorax artificial pneumothorax pneumoperitoneum.

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracoplasty operation

MAX BIESENTHAL Surgery of pulmonary tuberculosis

MAX BIESENTHAL and RALPH B BETTMAN Technique of various operations used for pulmonary tuberculosis

Artificial pneumothorax pneumolysis thoracoplasty motion picture and diagrammatic demonstrations

RALPH B BETTMAN Treatment of empyema injuries of the chest presentation of cases motion picture and diagrammatic demonstrations

WOMEN AND CHILDREN'S HOSPITAL

HELEN HAYDEN EMELIA GRYKOWAS MARGARET AUSTIN and NORA B BRANDENBURG Bronchoscopy in relation to asthma and allied pulmonary conditions lipiodol in jection

Friday Afternoon

COOK COUNTY HOSPITAL

JOHN B O'DONOGHUE FREDERICK TICE RICHARD JAFFE
M J HUBBY S H ROSENBLUM and A J HUBBY
Symposium Pulmonary tuberculosis
JOHN B O'DONOGHUE Operations

PRESBYTERIAN HOSPITAL

JOHN DORSEY Operations

Daily

ST LUKE'S HOSPITAL

PAUL HOLINGER Exhibit

FRACTURES AND TRAUMATIC SURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Operative fractures

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENNAN and M. J. MILLS
Traumatic surgery

ST ANTHONY DE PADUA HOSPITAL

T. W. SLOBE Fractures, phases of traumatic surgery

ST LUKE'S HOSPITAL

HART E. FISHER Electrical injuries, shock, burns and glare injury to the eyes with their preventive phases, treatment, resuscitation, etc. Evolution of resuscitation showing various methods from ancient time down to the present. Manual, mechanical and medical methods. Lantern slide and motion picture demonstration

T. HANSON and J. JANSEN Treatment of comminuted fractures of the leg

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

ARTHUR H. CONLEY and S. PERRY ROGERS Symposium
Blind pegging of fractures of the femur

FRED MILLER, T. C. BROWNING, EMILE DUVAL and G. M. LANDAU Fracture of both bones of lower leg

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Ward walk

ST JOSEPH'S HOSPITAL

HUGH McKENNA Demonstration clinic

ST LUKE'S HOSPITAL

H. E. MOCK, A. R. MORROW and C. E. SHANNON Skull fracture exhibit

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R. METZ Treatment of unusual fractures

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

C. R. G. FORRESTER, HORACE STIMSON and A. H. MASON
Symposium Fractures, nerve repair

COOK COUNTY HOSPITAL

SUMNER L. KOCH and associate Tendon and nerve suturing of the hand, hand infections

ST LUKE'S HOSPITAL

R. R. DUFF and R. R. DUFF, JR. The use of adhesive plaster in the treatment of burns, simple traction in dislocations of the shoulder, elbow and Colles fracture

VETERANS ADMINISTRATION FACILITY

S. K. LIVINGSTON Dry clinic

Wednesday Morning

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Ward walk
FREDERICK DYAS Ward walk (female)

EVANSTON HOSPITAL

DWIGHT CLARK Fractures about the knee joint

ST ANNE'S HOSPITAL

THOMAS E. MEANY Fractures and tendon transplantations

ST BERNARD'S HOSPITAL

L. B. DONKLE and M. E. CREIGHTON Fractures of the shaft of the femur

ST LUKE'S HOSPITAL

H. E. MOCK, A. R. MORROW and C. E. SHANNON Skull fracture exhibit

JOHN D. ELLIS Treatment of traumatic back injuries

Wednesday Afternoon

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS, JAMES J. CALLAHAN, CARLO S. SCUDERI, FREDERICK DYAS and GEORGE L. APPELBACH
Symposium Knee joint injuries

PASSAVANT MEMORIAL HOSPITAL

PAUL B. MAGNUSON and JAMES K. STACK Symposium on fractures

ST LUKE'S HOSPITAL

C. G. SHEARON and GRAHAM KERNWEIN Infections of the hand

Thursday Morning

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates Ward walk

GARFIELD PARK COMMUNITY HOSPITAL

J. J. CALLAHAN, H. N. WAIT and MILTON SCHMITT Demonstration clinic

JACKSON PARK HOSPITAL

ARRIE BAMBERGER Demonstration clinic

ST BERNARD'S HOSPITAL

R. S. WESTLINE and E. L. ARENSDORF Fractures of the wrist joint

ST JOSEPH'S HOSPITAL

HUGH McKENNA Demonstration clinic

ST LUKE'S HOSPITAL

H. E. MOCK, A. R. MORROW and C. E. SHANNON Skull fracture exhibit

H. E. MOCK and associates Hip fracture demonstration
WILL LYON Early closure of open wounds

ST MARY OF NAZARETH HOSPITAL

L. CZAJA Symposium Late results of fractures

U. S. MARINE HOSPITAL

HORACE P. STIMSON Ununited fractures with osteomyelitis

E. C. LUTTON and R. W. FLYNN Skeletal traction and countertraction in treatment of fractures

FRANCES E. WILLARD HOSPITAL

JAMES A. VALENTINE Clinic

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

ARTHUR H CONLEY and S PERRY ROGERS Blind pegging of fractures of the femur
 FRED MILLER T C BROWNING EMILE DUVAL and G M LANDAU Fracture of both bones of lower leg

COOK COUNTY HOSPITAL

WILLIAM R CUBBINS and associates Operative fractures
 GEORGE L APPELBACH Ward walk (female)

JACKSON PARK HOSPITAL

S W M ROBINSON C W HENNAN and M J MILLS Traumatic surgery

FRANCES E WILLARD HOSPITAL

FRED CARLS Clinic

WOMEN AND CHILDREN'S HOSPITAL

ARMINA HILL Minor injuries
 MARY E WILLIAMS Fractures, dislocations

Friday Morning

CHICAGO MEMORIAL HOSPITAL

C R C FORRESTER HORACE STIMSON and A H MASON Fractures nerve repair

COOK COUNTY HOSPITAL

WILLIAM R CUBBINS and associates Follow up clinic demonstration of cases

ST LUKE'S HOSPITAL

H E MOCK, A R MORROW and C E SHANNON Skull fracture exhibit

Friday Afternoon

COLUMBUS HOSPITAL

F MUELLER Fractures
 W L BEECHER Traumatic surgery

COOK COUNTY HOSPITAL

JAMES J CALLAHAN and CARLO S SCUDERI Cadaver demonstrations

Days to be Announced

COOK COUNTY HOSPITAL

DR GATEWOOD Symposium Fractures in children

HENROTIN HOSPITAL

ARTHUR R CONLEY Demonstration clinic

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

H C VOISIS and J J KEARNS Intracranial injury—demonstration of pathology physiology management surgical interference sequelae complications

Tuesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DE TAKATS Operation Lumbar sympathectomy Symposium Neurocirculatory Diseases
 R BRUNNER The use of neosynephrine in spinal anesthesia
 WILLIAM C BECK Selection of cases for sympathectomy demonstration of sympathectomized patients evaluation of results the management of lymphedema
 F K HICK Vascular accidents associated with coronary occlusion
 H C LUETH Unusual reactions following the use of nitroglycerine
 GEZA DE TAKATS The treatment of acute arterial occlusion operability of hypertension, demonstration of cases
 H L MISHKIN and P J SARMA The treatment of varicose veins and ulcers
 J T REYNOLDS Amputations in peripheral vascular disease

Tuesday Afternoon

MERCY HOSPITAL

C F SCHULTZ and H C VOISIS Neuro-ophthalmology Presentation of cases with fundi perimetric field findings discussion of diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

PRESBYTERIAN HOSPITAL

A VERBRUGGHEM Dry clinic and demonstration

ST LUKE'S HOSPITAL

ERIC OLDBERG Operation
 GEZA DE TAKATS Demonstration of late results in patients following sympathectomy for neurocirculatory disorders
 JOHN COULTER Physical therapy in the treatment of peripheral vascular disease
 GEORGE K FENY The management of the surgical diabetic
 CARL A JOHNSON Neosynephrine in postoperative shock
 RICHARD CAPPS The carotid sinus syndrome and its surgical significance
 GEORGE SCUPHAM Classification in hypertension

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG Operations and demonstration of cases

Wednesday Afternoon

COOK COUNTY HOSPITAL

A VERBRUGGHEM Surgical paraplegia—etiology, pathology classification physiology, treatment prognosis

PRESBYTERIAN HOSPITAL

A VERBRUGGHEM Operations

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

P C BUCY and R B CLOWARD Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG Operations and demonstration of cases

Thursday Afternoon

MERCY HOSPITAL

H C VORIS and associates Symposium Management of cerebral gliomas

H C VORIS and H E LANDES Demonstration of choroid plexus resection in hydrocephalus, cytometric studies in neurological lesions

C F SCHAUB and H C VORIS Neuro-ophthalmology Presentation of cases with fundi perimetric field findings, discussion of diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

PRESBYTERIAN HOSPITAL

A VERBRUGGHE Operations

MICHAEL REESE HOSPITAL

Symposium Intracranial Suppuration

ROY GRINKER Neurological aspects of intracranial suppuration

A VERBRUGGHE Surgical aspects of brain abscess

Friday Afternoon

PASSAVANT MEMORIAL HOSPITAL

LOYAL DAVIS and JOHN MARTIN Neurological surgery Presentation of cases emphasizing diagnosis and treatment

PRESBYTERIAN HOSPITAL

A VERBRUGGHE Operations

ST LUKE'S HOSPITAL

ERIC OLDBERG Operation

EXPERIMENTAL SURGERY

Friday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

LEON ARIES Acceleration of bone growth and repair as determined by deposition of dye in the callus (By feeding dogs dyes which are deposited in the callus experimental fractures are studied to determine what substances accelerate bone growth and repair) Lantern slide demonstration

R A BUSSABARGER, S FREEMAN and A C IYV The rôle of the stomach in calcification of bone (Demonstration of gastrectomized puppies showing homogenous osteoporosis This demonstration shows the necessity of observance of dietary care in gastrectomized patients) Lantern slide demonstration

ELMER J KOCUR The effect of various foods upon bile secretion with and without return of bile to the gastro intestinal tract (Demonstration of animals This shows the necessity of adequate dietary control of patients with biliary fistulas)

C R SCHMIDT and J M BEAZELL The effect of diet on pancreatic secretion (The results obtained guide the postoperative care of a patient with duodenal fistula)

WILLIAM BACHRACH and SAMUEL J FOGELSON Common duct transplantation (Demonstration of animal Results obtained show the site of implantation of the common duct is important in preventing subsequent ascending infections of the biliary passages)

MICHAEL L MASON and HARVEY S ALLEN Experimental studies on tendon repair (Histologic studies of tendon repair after use of varied suture material, grafts and different techniques)

LEO M ZIMMERMAN Surgical repair of inguinal hernia as guided by anatomical studies (A simplification of surgical technique for the treatment of inguinal hernia after evaluating the anatomy)

JOHN MARTIN The negative effects of midbrain lesions upon the gastric secretion, motility and gastro intestinal ulceration in monkeys and cats A Horsley Clarke apparatus was used to produce midbrain lesions in cats and monkeys No changes were observed in gastro intestinal function and activity

H CHOR The rational of physical therapy in the treatment of muscle disorders Experimental observations on massage, passive movement of electrical stimulation and of rest upon muscle atrophy and regeneration in the lower motor neuron type of paralysis

MICHAEL REESE HOSPITAL

STAFF Demonstration in experimental surgery

Days to be Announced

ALBERT MERRITT BILINGS HOSPITAL

LABORATORY STAFF Demonstration

RESEARCH AND EDUCATIONAL HOSPITALS

WARREN H COLE and associates Demonstration

PLASTIC AND FACIOMAXILLARY SURGERY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER Facial plastic surgery

SIDNEY POLLACK Nasal fractures

BERNARD M COHEN Nasal and ear prostheses

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

CASPER M EPSTEIN Plastic, faciomaxillary surgery

COOK COUNTY HOSPITAL

JOSEPH E SCHAEFER Demonstration of cases showing corrected temporomandibular ankylosis, harelips and cleft palates, pedicle flap and full thickness graft cases, repair of burns, traumatic injuries, plastic repairs of controlled carcinoma cases

ST JOSEPH'S HOSPITAL

WILLIAM H G LOGAN Oral surgery

Tuesday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery treatment of injuries to the face.

Wednesday Morning

ST LUKE'S HOSPITAL

H. A. POTTS and F. W. MERRIFIELD Demonstration clinic

Wednesday Afternoon

MOUNT SINAI HOSPITAL

E. ALSON and associates Oral surgery

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations

Thursday Morning

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER. Demonstration of cases showing carcinoma of mouth, lips and face with colored photographs of lesions before and after radiation.

MICHAEL REESE HOSPITAL

CASPER EPSTEIN. Oral surgery

ST JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN Oral surgery

Thursday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Dry clinic.

Friday Morning

ST LUKE'S HOSPITAL

H. A. POTTS and F. W. MERRIFIELD Demonstration clinic

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL

L. W. SCHULTZ Dry clinic and demonstration.

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED Operations.

RESEARCH AND EDUCATIONAL HOSPITALS

L. W. SCHULTZ Oral surgery with particular reference to cleft palates and harelips.

Day to be Announced

COOK COUNTY HOSPITAL

I. MUSKAT Plastic surgery of the nose and face

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL

DISRAELI KOBAK General physical therapy procedures

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

JOHN S. COULTER and S. L. OSBORNE. Clinical and experimental investigations of short wave medical diathermy

MICHAEL REESE HOSPITAL

C. O. MOLANDER. Ward walks physiotherapy methods.

Tuesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. In posttraumatic conditions

MUNICIPAL TUBERCULOSIS SANITARIUM

JOHN S. COULTER and LEO HARDT Ultraviolet radiation in the treatment of gastro-intestinal tuberculosis

Tuesday Afternoon

COOK COUNTY HOSPITAL

I. F. HARMON Physical therapy in infantile paralysis.

MICHAEL REESE HOSPITAL

S. PERLOW and C. O. MOLANDER. Physical therapy in the treatment of circulatory disturbances.

Wednesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. In postoperative traumatic infections

GARFIELD PARK COMMUNITY HOSPITAL

MILTON SCHMITT Hyperpyrexia in gonorrheal arthritis.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

HERMAN CHOR. Rationale of physical therapy in muscle disorders.

JOHN S. COULTER Demonstration of clinical and experimental results.

MICHAEL REESE HOSPITAL

FRANK GLASSMAN and C. O. MOLANDER. Physical therapy in the treatment of fractures.

Wednesday Afternoon

COOK COUNTY HOSPITAL

I. F. HARMON Physical therapy in neurosurgical and neurological conditions.

GARFIELD PARK COMMUNITY HOSPITAL

MILTON G. SCHMITT The value of heating tissues by induction hyperpyrexia.

PASSAUNT MEMORIAL HOSPITAL

J. S. COULTER Physical therapy in fractures.
SUMNER L. KOCH MICHAEL L. MASON and J. S. COULTER. Physical therapy in hand injuries.

MICHAEL REESE HOSPITAL

I. WOLIN and C. O. MOLANDER. Physical therapy in the treatment of poliomyelitis.

SIDNEY SIDEMAN and C. O. MOLANDER. Physical therapy in treatment of paresthesias.

Thursday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in low back conditions

ILLINOIS CENTRAL HOSPITAL

JOHN S COULTER Under water exercises in the treatment of fractures of weight bearing bones

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J S COULTER and S L OSBORNE Hyperpyrexia in chronic infectious arthritis

F CHANDLER J R NORCROSS and J S COULTER Management of low back conditions

MICHAEL REESE HOSPITAL

BERT FYNN Hyperpyrexia in the treatment of gonorrheal arthritis

Thursday Afternoon

COOK COUNTY HOSPITAL

I F HUMMON Manipulative treatment in low back conditions

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

EMIL HAUSER and J S COULTER The rôle of physical therapy in common disorders of the foot

MICHAEL REESE HOSPITAL

JULIUS GRINKER and C O MOLANDER Physical therapy in treatment of peripheral nerve injuries

Friday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK Physical therapy in bursitis

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J S COULTER Physical therapy in traumatic arthritis

MICHAEL REESE HOSPITAL

LESTER FRANKENTHAL and C O MOLANDER Physical therapy in treatment of chronic pelvic inflammation

Friday Afternoon

COOK COUNTY HOSPITAL

I F HUMMON Physical therapy in the prevention of deformities

ST LUKE'S HOSPITAL

JOHN S COULTER Physical therapy in reconstruction surgery

ROENTGENOLOGY

Monday Afternoon

ST LUKE'S HOSPITAL

L L JENKINSON, E W ROBERTS A F HUNTER and W WASKOW Lesions of terminal ileum

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY Newer concepts in the treatment of carcinoma

ST LUKE'S HOSPITAL

E L JENKINSON, E W ROBERTS, A F HUNTER and W WASKOW Exhibit of interesting cases, pathology shown by x ray

ST MARY OF NAZARETH HOSPITAL

C J CHALLENGER X ray studies of surgical conditions

Tuesday Afternoon

ST ANTHONY DE PADUA HOSPITAL

L S TICHY Sclerosis demonstration

ST BERNARD'S HOSPITAL

B C CUSHWAY, R J MAIER and E R LEWIS Roentgen therapy of inflammation and infections of the face and neck

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS, A F HUNTER and W WASKOW Gall bladder visualization following medical treatment

Wednesday Morning

ST LUKE'S HOSPITAL

E L JENKINSON, E W ROBERTS, A F HUNTER and W WASKOW Gall bladder visualization following surgical drainage

Wednesday Afternoon

AUGUSTANA HOSPITAL

DAVID S BEILEN Roentgen diagnosis of gastro-intestinal lesions

ALBERT MERRITT BILLINGS HOSPITAL

PAUL C HODGES and associates X ray diagnosis

ST LUKE'S HOSPITAL

E L JENKINSON, E W ROBERTS, A F HUNTER and W WASKOW Interesting bone pathology

Thursday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY Newer concepts in the treatment of carcinoma

PASSAVANT MEMORIAL HOSPITAL

JAMES T CASE Technical considerations in gastrointestinal radiology, round table discussion on radiation therapy of carcinoma of breast

EARL BARTY The evolution of primary tuberculous infection of the lungs in roentgenograms, round table discussion on miscellaneous roentgen therapeutic applications

RESEARCH AND EDUCATIONAL HOSPITALS

ADOLPH HARTUNG Conference on x ray diagnosis, with particular reference to bone dystrophy, lesions of the urinary tract, brain tumors and unusual lesions of the gastro-intestinal tract.

ST LUKE'S HOSPITAL

E. L. JENKINSON, E. W. ROBERTS, A. F. HUNTER and W. WALKER Exhibit of interesting cases pathology shown by x ray

Thursday Afternoon

COOKE COUNTY HOSPITAL

P. MERT F. McNAULT High voltage therapy of malignant diseases

M. J. HERTY Roentgenological examination of appendix

MOUNT SINAI HOSPITAL

MAX COHN, G. DAVILLOS and E. LEWIN Demonstrations of interesting radiological conditions

ST LUKE'S HOSPITAL

E. L. JENKINSON, E. W. ROBERTS, A. F. HUNTER and W. WALKER Malignancies of lungs

Friday Morning

ST LUKE'S HOSPITAL

E. L. JENKINSON, E. W. ROBERTS, A. F. HUNTER and W. WALKER Exhibit of interesting cases pathology shown by x ray

TUMORS AND IRRADIATION

Monday Afternoon

ST ELIZABETH'S HOSPITAL

J. LEAMS Radium treatment of fractures

VETERANS ADMINISTRATION FACILITY

G. P. ALLAREN Regular tumor clinic

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

LADORE PILOT Pathology of malignant growths in relation to therapeutic indications

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME F. STRAUSS and SAMUEL PEARLMAN Radium therapy in malignant tumors of the head and neck demonstration of cases and technique

ST ELIZABETH'S HOSPITAL

M. G. LUTEN Sarcoma of the stomach

VETERANS ADMINISTRATION FACILITY

A. E. WILLIAMS Deep x ray and radium therapy

Tuesday Afternoon

RAVENSWOOD HOSPITAL

C. BUSWELL, J. J. MOORE, H. P. SANDERS and L. E. SCHAEFFER Cancer clinic, presentation of specimens, lantern slides, cases illustrating melanomas of shoulder and jaw

Friday Afternoon

AUGUSTANA HOSPITAL

DAVID S. BIRLEY Roentgen diagnosis of lesions of urinary tract

COOKE COUNTY HOSPITAL

J. PAUL BENVENISTE Roentgenological examination of the kidneys, ureters and bladder

ROBERT F. McNAULT High voltage therapy of malignant diseases

ST LUKE'S HOSPITAL

E. L. JENKINSON, E. W. ROBERTS, A. F. HUNTER and W. WALKER Exhibit of interesting cases pathology shown by x ray

Days to be Announced

HENFOTIN HOSPITAL

ARTHUR R. HANSEN X ray demonstration

WESLEY MEMORIAL HOSPITAL

FRANK L. HURLEY Therapeutic application of x ray machines in obscure gastric and duodenal lesions the use of x-ray in conjunction with surgery of the large bowel

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S. LEVINSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H. HOLINGER Bronchogenic aspects

WILLARD VAN HAZEL Surgical considerations demonstration of cases and specimens surgical treatment of mediastinal tumors

T. J. WACHOWSKI Roentgenological consideration of mediastinal tumors

M. JOANNIDES Collapse therapy of pulmonary tuberculosis

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Tumor Surgery

A. BRUNSWICK Experimental production of tumors and the efficacy of Coley's toxin in the treatment of experimental sarcoma palliative treatment of pulmonary metastases from malignant tumors in a rabbit in treatment of benign giant cell tumors of bone

D. B. PRINCE and associates Studies in the etiology, diagnosis and treatment of bone tumors

HARVEY WILSON Extrahepatic osteifying tumors

VETERANS ADMINISTRATION FACILITY

MAX CUTLER Annual tumor clinic Presentation of cancer cases, indications, technique and results of radium therapy

G. R. ALLAREN Diagnosis and treatment

*Thursday Morning***COLUMBUS HOSPITAL**

D A ORTH M HANNAH and H E DAVIS Breast cancer

LUTHERAN DEACONESS HOSPITAL

ISADORE PILOT Pathology of malignant growths in relation to therapeutic indications

MFRCY HOSPITAL

W J PICKETT Unusual cases of malignancy

MICHAEL REESE HOSPITAL

MAX CUTLER and staff Results of radiation treatment of cancer of mouth, tonsil, pharynx and larynx, presentation of cases. Radiation treatment of cancer of the breast, presentation of cases. Motion pictures illustrating technique of radium treatment of cancer of mouth and cancer of cervix. Transillumination of breast

ST ELIZABETH'S HOSPITAL

LEO M ZIMMERMAN Mediastinal tumors

VETERANS ADMINISTRATION FACILITY

A E WILLIAMS Inspection of deep x ray and radium therapy unit

WESLEY MEMORIAL HOSPITAL

GUY S VAN ALSTYNE Carcinoma of the breast, combined surgical and x ray treatment

*Thursday Afternoon***PASSAVANT MEMORIAL HOSPITAL**

MAX CUTLER The organization of a tumor clinic. Personnel, equipment records follow up

Carcinoma of the Breast

JOHN A WOLFER Surgical considerations

JAMES T CASE Pre and postoperative x ray radiation

L M ROSE THAL Radium treatment

MAJOR GREENE Bronchiogenic tumors of the neck

JOHN F DELPH and EARL BARTH Carcinoma of the larynx, hypopharynx and tonsil

JOHN MOHARDT A survey of some proposed cancer cures

RESEARCH AND EDUCATIONAL HOSPITALS

Symposium Diseases of the Gastro Intestinal Tract

GEORGE MILLES Pathology of carcinoma of stomach

W H COLE Total gastrectomy

T J WACHOWSKI X ray diagnosis of carcinoma of stomach

C L BIRCH Anemia associated with total gastrectomy

M H STREICHER Diagnosis of carcinoma of the rectum

C B PUESTOW Surgical treatment of carcinoma of the rectum

BERNARD PORTIS Surgical treatment of complicated duodenal ulcers

I L McVILLAN Regional ileitis

J L SPIVACK Tuboalvular stoma with particular reference to gastrostomy

H O WERNICKE The injection treatment of hernias

*Friday Morning***MFRCY HOSPITAL**

HENRY L SCHMITZ and associates Symposium Radiologic therapy of malignancy

RESEARCH AND EDUCATIONAL HOSPITALS

R B MALCOLM Operations Neck dissection, carcinoma of breast, surgical pathology of breast tumors

T J WACHOWSKI X ray treatment of carcinoma of breast

ARRIE BAMBERGER Tying tumor with case report

ST BERNARD'S HOSPITAL

CHESTER C GUY Surgical pathology of bone tumors

ST LUKE'S HOSPITAL

H L MOCK WILLIAM BROWN E W RYERSON E F HIRSCH and E L JENKINSON Tumor clinic Demonstration of pathology, diagnosis, treatment of malignancies of the breast and collar bone

VETERANS ADMINISTRATION FACILITY

G R ALLABEN Regular tumor clinic

WESLEY MEMORIAL HOSPITAL

EARL LATIMER Unusual breast tumors

*Friday Afternoon***PRESBYTERIAN HOSPITAL**

CARL APPELBACH and F SQUIRE Dry clinic

*Day to be Announced***HENROTIN HOSPITAL**

SAMUEL LEVINSON Surgical pathology

OPHTHALMOLOGY

Monday Afternoon

- ALBERT MERRITT BILLINGS HOSPITAL
A C KRAUSE Fundus diagnosis
- CHILDREN'S MEMORIAL HOSPITAL
G GUTBOR Orthoptics.
- COOK COUNTY HOSPITAL
E B FOWLER Fundus diagnostic clinic.
- ILLINOIS EYE AND EAR INFIRMARY
R VON DER HEYDT Operation for glaucoma and cataract.
DWIGHT C ORCUTT Dry clinic
- MERCY HOSPITAL
C F SCHAUB F I BARNETT and E A ROLING Fundus clinic
- MICHAEL REESE HOSPITAL
PHILIP HALPER Orthoptics
- RUSH MEDICAL COLLEGE
DR HOLMES Orthoptics

Tuesday Morning

- NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
GEORGE GUTBOR Orthoptic training classification of squint
SANFORD R GIFFORD Concomitant and paralytic squint
- RUSH MEDICAL COLLEGE
DR WILBER Histopathology

Tuesday Afternoon

- ALBERT MERRITT BILLINGS HOSPITAL
C V DEVNEY Orthoptics
- COLUMBUS HOSPITAL
M GOLDENBURG Eye clinic
- COOK COUNTY HOSPITAL
C F YERGER Medical ophthalmology
- ILLINOIS EYE AND EAR INFIRMARY
THOMAS D ALLEN Operation for glaucoma and cataract
LOUIS HOFFMAN and E K FINDLAY Dry clinics.
- MERCY HOSPITAL
C F SCHAUB and H C VORIS Neuro-ophthalmology*
Presentation of cases with fundi, perimetric field findings, discussion of diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.
- MOUNT SINAI HOSPITAL
J LEBENSOHN and E SELINGER Clinic.
- MICHAEL REESE HOSPITAL
T M SHAPIRA Fundus clinic
- RUSH MEDICAL COLLEGE
DR JACOBSON Fundus clinic.

Wednesday Morning

- COOK COUNTY HOSPITAL
SANFORD R GIFFORD Retinal detachment.
- RUSH MEDICAL COLLEGE
W F MONCREIFF Cataract.

Wednesday Afternoon

- ALBERT MERRITT BILLINGS HOSPITAL
S S BLANKSTEIN End results of retinal detachment operations
- CHILDREN'S MEMORIAL HOSPITAL
R C GAMBLE and E A VORISEK Diagnostic clinic.
- ILLINOIS EYE AND EAR INFIRMARY
DWIGHT C ORCUTT Operation for glaucoma and cataract.
S J MEYER Retinal detachment.
K H CHAPMAN Orthoptics.
- MERCY HOSPITAL
C F SCHAUB F I BARNETT and E A ROLING Fundus clinic.
- MICHAEL REESE HOSPITAL
S J MEYER and D SNYDACKER Retinal detachment clinic
- U S MARINE HOSPITAL
ALFRED N MURRAY Eye injuries.

Thursday Morning

- ILLINOIS MASONIC HOSPITAL
ALVA SOWERS Cataract extraction employing Elschnig technique, discussion of dinitrophenol cataracts—treatment, results.

Thursday Afternoon

- ALBERT MERRITT BILLINGS HOSPITAL
L BOTHMAN Macular disease
- COLUMBUS HOSPITAL
M GOLDENBURG Eye clinic.
- COOK COUNTY HOSPITAL
E B FOWLER Fundus clinic.
- ILLINOIS EYE AND EAR INFIRMARY
E K FINDLAY and LOUIS HOFFMAN Operation for glaucoma and cataract.
THOMAS D ALLEN Glaucoma.
- MERCY HOSPITAL
C F SCHAUB and H C VORIS Neuro-ophthalmology
Presentation of cases with fundi, perimetric field findings, diagnostic problems, presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.
- MICHAEL REESE HOSPITAL
JACK COWAN Glaucoma clinic.

Friday Afternoon

- ALBERT MERRITT BILLINGS HOSPITAL
DR MCSHELLMAN Cataract results.

CHILDREN'S MEMORIAL HOSPITAL

R O RISER Diagnostic clinic

ILLINOIS EYE AND EAR INFIRMARY

S J MEYER Operation for glaucoma and cataract

R VON DER HEYDT Slit lamp demonstration

RUSH MEDICAL COLLEGE

E SFLINGER Medical ophthalmology

Days to be Announced

COLUMBUS HOSPITAL

M GOLDENBURG Glaucoma clinic

HENROTIN HOSPITAL

GEORGE W MAHONEY, F A ROLING and IRVING BAR
NETT Eye clinic

OTOLARYNGOLOGY

Monday Afternoon

COOK COUNTY HOSPITAL

NORMAN LESHIN Pneumonography Interesting cases
with methods of examination and diagnosisSAMUEL PEARLMAN Carcinoma of the larynx, bronchus
copy, esophagoscopy

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER, SIDNEY POLLACK and BERNARD M
COHEN Nasal plastic surgery, demonstration of nose
and ear prosthesis

Symposium Intracranial Otogenic Complications

M GLATT Petrositis

JACOB LIFSCHUTZ Brain abscess

C H CHRISTOPH Lateral sinus thrombosis

SAMUEL SALINGER Facial plastic surgery, presentation
of cases

RESEARCH AND EDUCATIONAL HOSPITALS

OLIVER E VAN ALVEA Surgical anatomy of the nasal
sinuses

MANUEL G SPIESMAN Diseases of the pharynx

SALVIO A SCIARFETTA Conservative treatment of chronic
suppurative otitis media

RUSH MEDICAL COLLEGE

LOUIS T CURRY and FRANK WOJNIAK Sulfanilamide in
the treatment of meningitis

Tuesday Morning

HENROTIN HOSPITAL

M REESE GUTTMAN Malignant diseases of the head and
neck with special reference to the larynx

MOUNT SINAI HOSPITAL

JOSEPH C BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S M
MORWITZ, FRANCIS L LEDERER, M R GUTTMAN and
associates ClinicsNORTHWESTERN UNIVERSITY MEDICAL
SCHOOLJ F DELPH, A H ANDREWS and GLENN J GREENWOOD
Technique of endobronchial aspiration

T P O'CONNOR Nasopharyngitis

MARION A ANDREWS Results of different reading
methods for raising the temperature of the antrum

GLENN J GREENWOOD Audiometric readings in allergy

H C BALLENGER Audiometric testing

J F DELPH Benign tumors of the vocal cords

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME E STRAUSS and SAMUEL PEARL
MAN Radium therapy in malignant tumors of the head
and neck, demonstration of cases and technique

ST JOSEPH'S HOSPITAL

AUSTIN A HAYDEN Conservation of hearing, mastoid and
sinus surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL

JACOB LIFSCHUTZ Demonstration clinic

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CISPER ERSTEIN Nasal and facial
plastic surgery, treatment of injuries to the face

RESEARCH AND EDUCATIONAL HOSPITALS

FRANCIS LEDERER Ear, nose and throat plastic surgery

PAUL H HOLINGER Diseases of the larynx

RUSH MEDICAL COLLEGE

ELMER HAGEN and PAUL CAMIBELL Pathology of the
petrous bone in cases dying of meningitis, lantern slides

ST MARY OF NAZARETH HOSPITAL

J J KILLEEN Mastoiditis in children

Wednesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S M
MORWITZ, FRANCIS LEDERER, M R GUTTMAN and
associates Clinics

ST ELIZABETH'S HOSPITAL

F A DULAK Ozena

Wednesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

J THEOBALD Complications of middle ear infections

SHERMAN L SHAPIRO Neuro otology

DR PELOUZE Deep neck infections

RUSH MEDICAL COLLEGE

THOMAS W LEWIS and RICHARD WATKINS Causative
factors and results of treatment of vasomotor rhinitis
with foreign protein

ST ANNE'S HOSPITAL

JERRY HAYDEN Ear, nose and throat clinic

HARRY M PETERSON Surgical demonstration and clinic

Thursday Morning

MERCY HOSPITAL

HERBERT NASH and R KERWIN Anatomy and physiology
of nose and accessory sinusesThe Proetz method of visualization showing pictures and
demonstration of method

G J MUSGRAVE Ferris Smith operation
 C H CHRISTOPH Maxillary sinuses intranasal radical
 C T JORDAN Caldwell Luc operation

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M
 MORWITZ FRANCIS LEDERER M R GUTTMAN and
 associates Clinics

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

L B AREY B J ANSON J GORDON WILSON and asso-
 ciates Reconstruction of tonsils stapes petrous bone
 J G WILSON and B J ANSON Reconstruction of bone
 pathology in cases of deafness.

Motion Pictures of Vestibular Reaction

J F DELPH Simplified caloric tests
 J GORDON WILSON Spontaneous nystagmus in lesions
 of the brain
 E L ROSS Toxic reactions in animals

ST JOSEPH'S HOSPITAL

AUSTIN A HAYDEN Conservation of hearing mastoid and
 sinus surgery

Thursday Afternoon

COOK COUNTY HOSPITAL

NORMAN LESHIN Pneumonography Interesting cases
 with methods of examination and diagnosis
 SAMUEL PEARLMAN Carcinoma of the larynx bronchos-
 copy esophagoscopy

RESEARCH AND EDUCATIONAL HOSPITALS

NATHAN H FOX and JOHN W HARNED JR Rhinologic
 surgery allergy in relation to otolaryngology
 FRANCIS LEDERER and N T PATTENGALE Cancer of the
 ear nose and throat

RUSH MEDICAL COLLEGE

GEORGE E SHAMBAUGH JR and LINTON WALLNER The
 treatment of deafness

Friday Morning

COOK COUNTY HOSPITAL

JACOB LIFSCHUTZ Demonstration clinic

EVANGELICAL DEACONESS HOSPITAL

JOHN M BICK Submucous resection and tonsillectomy

MOUNT SINAI HOSPITAL

JOSEPH C BECK ALFRED LEWY JACOB LIFSCHUTZ S M
 MORWITZ FRANCIS LEDERER M R GUTTMAN and
 associates Clinics

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

A R HOLLENDER Physical therapeutic methods
 W THEOBALD Nasal accessory sinus disease
 PAUL H HOLINGER Bronchoscopy and esophagoscopy

RUSH MEDICAL COLLEGE

DANIEL B HAYDEN and E L CHAINSKI Conditions pro-
 ducing tinnitus evaluation of methods of treatment

Days to be Announced

BILLINGS MEMORIAL HOSPITAL

J R LINDSAY Petrositis septic otitis and lateral sinus
 thrombosis

CHILDREN'S MEMORIAL HOSPITAL

GEORGE LIVINGSTON PAUL HOLINGER and associates.
 Intracranial complications of ear infections bronchos-
 copy in children, endoscopic cases.

COOK COUNTY HOSPITAL

I MUSKAT Plastic surgery of the nose and face
 S PEARLMAN Diseases of the neck and larynx including
 laryngoscopy and bronchoscopy
 L CURRA Mastoiditis and meningitis
 A LEWY The mastoid and the labyrinth
 T C GALLOWAY and H E DAVIS Selective treatment in
 malignancy about the head

ILLINOIS EYE AND EAR INFIRMARY

ALFRED LEWY Chronic suppurative otitis media
 JOHN CAVANAUGH Chronic sinusitis diagnosis and surgi-
 cal treatment.

SURGERY

GYNECOLOGY AND OBSTETRICS

An International Magazine, Published Monthly

VOLUME 65

OCTOBER, 1937

NUMBER 4

SOME ASPECTS OF MALIGNANT TUMORS OF THE KIDNEY

EDWIN BEER, M D, F A C S, New York, New York

IT IS a great pleasure to take part in this meeting to do honor to the memory of our old friend, Dr B A Thomas, who was much interested in the problems of urological surgery. I have selected for my theme, a discussion of malignant tumors of the kidney, and while it is impossible to cover the entire field in this brief address, I will present a collection of interesting experiences in the diagnosis and treatment of kidney neoplasms, dealing especially with tumors arising in the parenchyma, in the mucosa of the calyx and of the pelvis, and in the ureter.

ORIGIN AND PATHOLOGY

There are definite varieties of tumors involving the kidney, depending upon their origin. The most common tumors in adults are the hypernephroid carcinomas, originally described by Grawitz, which develop from the cortex, whereas in the young, and occasionally in adults, one encounters the mixed tumors, usually called Wilms tumors. In addition, in adults, rarely in children, one sees papillary, benign and malignant tumors, arising from pelvic and calyceal mucosa.

Although a great deal of work has been done on the origin of so called malignant (and benign) Grawitz tumors, usually called hypernephromas (Birsch Hirschfeld), which are clear celled carcinomas and resemble in many

respects similar tumors arising from the cortex of the adrenal, it is still in doubt whether these tumors arise from the kidney parenchyma or from adrenal rests. Many of these tumors in gross look like lipomas before extensive degeneration takes place, and appeared in the medical literature as lipomas, angiosarcomas, peritheliomas and the like, before Grawitz suggested their origin from adrenal rests. In view of the great frequency of occurrence of adrenal rests along the spermatic and ovarian veins, as well as in the kidney and liver, it would be surprising if adrenal rests give rise to these tumors in the kidney, as similar tumors are not frequently found in other locations, where adrenal rests have been known to occur. In fact, this reasoning, which I presented to Oscar Stoerck some 32 years ago while working in the Pathological Institute of the Allgemeine Krankenhaus in Vienna, led him to review the whole situation. I had noted in the study of 150 livers obtained at autopsy that just below or in Glisson's capsule in the right lobe of the liver there was an incidence of 6 adrenal rests, or 4 per cent. Schmorl had previously found similar adrenal rests in the liver in the same location. Another worker in Vienna, Wiesel, had found rests in over 90 per cent of autopsy cases, situated along the spermatic and ovarian veins, in the broad ligament, and even in the tunica vaginalis testes. Professor Marchand had suggested that these adrenal rests might de-

B. A. Thomas Oration presented before the Philadelphia Urological Society, January 25, 1937.

velop into tumors, thus supporting Grawitz's original contention that the large, fatty looking vascular tumors, occurring in the kidney cortex, were derived from these rests.

A priori one would have expected similar hypernephroid tumors from other adrenal rests. The fact that they have rarely occurred, only a few cases having been described, seemed to confirm my doubts and fortify O-car Stoerck's opinion based on microscopic studies, that these tumors in the kidney, known as Grawitz tumors, clear cell carcinomas, hypernephroid in type, were derived from cells of the kidney parenchyma as Weichselbaum and Greenish, as well as Zudeck, had previously contended. It must be evident that although logic, as well as some microscopic criteria, seems to point away from the origin of these tumors from adrenal rests, the final decision will be reached only by biochemical studies. It is interesting to relate that a Philadelphian, A. Croftan, in Virchow's *Archiv* in the beginning of this century, was the first one to apply biochemical tests to these tumors. He found that extracts of these tumors produced glyco-urina, much like extracts from the adrenal and he also found a definite iodine reaction, which he described at the same time. My attempt to confirm this was unsatisfactory.

In the meanwhile, L. Pick made the unusual observation in a case of hypernephroid tumor that not only was the cortex, but the medulla, of the adrenal recognizable in the tumor. This to date is a unique observation. Years ago, still interested in the problem of the origin of these tumors, I asked Dr. Braasch to have extracts made from the tumors at Rochester, to see whether Dr. Kendall could extract from the hypernephroid tumors the cortin, which is usually extracted from the adrenal cortex. According to his report published within the last year, the laboratory at the Mayo Clinic has been unable to extract cortin from these growths up to date.

In 1927 Tschoboksarow and Melkun published a study of adrenal lipase which was extracted from human and animal adrenal glands and was highly sensitive to chloral hydrate. Subsequently in proved cases of adrenal disease they identified this same lipase

in patients' sera. Jorns (1933) confirmed this in a case of Addison's disease and applied these stalagmometric methods to a series of hypernephroid tumors and in a series of 8 Grawitz kidney tumors, the serum of the patients in 6 gave positive adrenal lipase reactions, and the extracts of all 8 tumors gave the identical reaction, leading him to conclude that this specific lipase is given off to the serum by the tumors and demonstrates their origin from adrenal rests in the kidney. This remarkable study, as far as I know, has not been confirmed as yet.

It has been known for some years that tumors of the adrenal cortex may produce a hormonal disturbance leading to premature sexual development, masculinization and hirsutism. If these hypernephroid tumors were of adrenal, cortical origin one might expect similar disturbances, but as far as I know no such changes have been noted. It is just possible that only one of the layers of the cortex may produce such hormonal effects and the hypernephroid growths do not arise from this particular layer.

The absolute decision as to the origin of these tumors must still remain undecided, although the pathological microscopic anatomy frequently suggests the same structure as the carcinomas of the adrenal, derived from the adrenal cortex, and the microscopic grouping of the cells mimics those of the zona fasciculata (and reticulata) of the adrenal, these are not absolute evidence against a possible origin from the renal parenchyma. It is conceivable that our difficulties in extracting cortin from these tumors may have been due to the fact that the cortex of the adrenal, having 3 layers of different cells, all 3 of which may not produce cortin and as adrenal rests may contain only the fasciculata (and reticulata) layers the inability to recover cortin in these hypernephroid tumors is explicable without necessarily invalidating their possible origin from adrenal rests.

In addition to these hypernephroid tumors, the name actually implying that they are of adrenal rest origin, one finds definite, non-fatty looking types of carcinoma with typical microscopic picture and cells not comparable with those found in the Grawitz tumors.



Fig 1



Fig 2



Fig 3



Fig 4

Figs 1, 2, 3, and 4 Pyelograms of hypernephromas showing marked deformity of pelvis and calyces

Such types of carcinoma infiltrate the kidney parenchyma and do not produce the huge nodular growths, or Grawitz tumors, that are a much more frequent finding. Both types of neoplasms may invade the vascular



Fig. 5 Iyelogram of a large upper pole tumor on the left side closely simulating by palpation an enlarged spleen with a definite notch palpable directly under the abdominal wall below the level of the navel. The pelvis is pushed down into the iliac fossa.

channels though the hypernephroid tumor does so much more frequently, both may invade adjacent lymph glands, but these are much more likely to be involved in the true, non hypernephroid carcinomas. Very rarely one encounters a completely encapsulated hypernephroid tumor, which is spheroidal located in the cortex and shows no invasive characteristics and no particular evidence of proliferative activities. Some have looked upon these as benign hypernephromas and they resemble closely the tumors originating from adrenal rests outside of the kidney, the so called *strumæ suprarenales aberratae*, along the spermatic or ovarian veins, or in the broad ligament.

The mixed, or Wilms tumors, which also produce large renal tumors, are seen mainly in children and are very malignant. That their malignancy is not always the same is evidenced by the fact that every once in a while



Fig. 6 A similar case. In each case it is interesting to note that intraperitoneal organs can displace retroperitoneal organs. I have seen a large spleen displacing the left kidney toward the iliac fossa and after I had done a splenectomy the kidney returned almost to its normal position. Moreover, Cienfuentes de Madrid has shown in a case of hydatid cyst of the right lobe of the liver that the right kidney was displaced across the spine to the left and after taking care of the hydatid cyst the excretory urogram showed the return of the right kidney from the left lumbar gutter to the right side.

one encounters one of these enormous mixed tumors in adults. Such tumors are made up of derivatives of the 3 layers of the embryo, and on section are recognized as congenital mixed neoplasms. Although these tumors are the usual and most frequent type of tumor in children, every once in a while one encounters a hypernephroid neoplasm in the young. In view of these variations in the malignancy of the mixed tumors as well as in view of the possibility that one is dealing with a hypernephroid tumor in a child, one is naturally justified in attempting a removal of such a kidney irrespective of the size of the tumor, preferably after pre operative roentgen therapy.

The papillary tumors arising in the kidney pelvis, calyces and ureter at times associated



Fig 7. Pyelogram of a papillary carcinoma of the lower pole of the kidney, simulating clots filling the kidney pelvis, which, however, could not be washed out

with lithiasis, present an entirely different group of cases and rarely grow to the size of the hypernephroid or Wilms tumors. The pathology of these tumors is somewhat similar to those tumors that occur in the bladder mucosa, and have a tendency to make implants along the ureter and at the bladder ostium of the ureter, as well as over different parts of the bladder mucosa. They may be benign or malignant, and the earlier they are recognized, the more effectively they are dealt with. Rarely these growths may be squamous cell epitheliomas and not papillary.

Metastases along the ureter in the Grawitz hypernephromas, in the true renal carcinomas, and in the Wilms tumors are most exceptional, while in the group just described, they are sufficiently frequent to demand an aseptic nephro-ureterectomy with excision or destruction of the ureteral meatus in the bladder. Unless such a complete procedure is carried out at the original operation, a second or third operation may be required to remove im-



Fig 8. An excretory urogram of a large Wilms tumor in a child showing compression of the pelvis and calyces

plants in the ureter, as well as implants in the bladder.

Late metastases in hypernephroid tumors are not infrequent, and solitary distant metastases may be the first evidence of disease of the kidney. After nephrectomy, even with complete removal of the perinephric fat, all too often a local recurrence manifests itself shortly following the operation or some years later, and deep roentgen therapy does not prevent or control such recurrences. Distant metastases to the adrenals, bones, liver, kidney, lungs, brain, and occasionally to most unusual sites, may also appear early or very late, 7 to 10 or more years following the nephrectomy. These late metastases are often solitary and unfortunately we do not know just what biological forces delay the development of these secondary tumors. They surely must have been deposited (if solitary) prior to the nephrectomy, but some forces in the patient's body hold them in check for many years until finally they become clinically evi-



Fig 9 A retrograde pyelogram of a patient with hypernephroma the size of a baseball. Owing to the resilience of the tissue pyelographic picture shows practically normal pelvis and calyceal system except for slight dilatation of the upper calyx

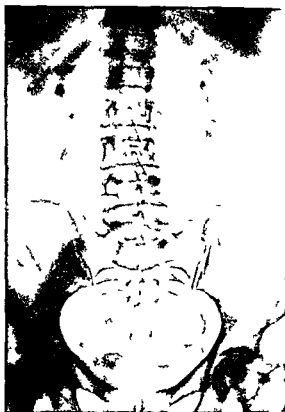


Fig 10 An excretory urogram of the same patient showing typical picture diagnostic in every way of compressing hypernephroma

dent. Probably similar forces delay the local recurrences in the wound in those cases in which years elapse before a local mass becomes evident. A knowledge and understanding of these forces would be of invaluable aid in fighting malignant growths of other types and other organs, as the phenomenon is not entirely unique to hypernephroid, renal tumors.

Metastases have also been known to regress and disappear, probably completely, without any therapy. Multiple metastases developed in the previously clear lung of one of my patients. Some months following operation, this patient developed a cough, and a roentgen picture was taken by the same radiologist, who found multiple large and small metastases in the lungs. Another picture about 5 months later by the same radiologist showed the lungs clear and the cough had disappeared. Another case of adrenal carcinoma similar to the above hypernephroid kidney tumor, in which

the multiple deposits in the lungs disappeared has been seen by me in recent years. This peculiar phenomenon of disappearance of metastases is probably closely related to that previously touched upon, and some of our laboratory efforts should be directed toward finding the biological forces that keep local recurrences and solitary distant metastases in temporary check, as well as the similar forces that cause metastases, such as have been seen in the lungs by a few other observers and our selves, and have been found to disappear completely.

RENAL VEIN TUMOR THROMBOSES AND INVOLVEMENT OF THE INFERIOR VENA CAVA

Perhaps the best evidence of the delay in the recognition and treatment of the largest group of these malignant kidney tumors, the hypernephroid type, is to be found in the incidence of involvement of the renal veins



Fig 11 Pyelogram of papilloma of the uppermost calyx, showing irregular filling and distention of the calyx



Fig 12 Pyelogram showing irregular density in the moderately distended pelvis, due to papilloma of the pelvis. In addition, the patient had a tiny papilloma at the corresponding ureter ostium, which helped clarify the interpretation of the pyelogram. This is a positive print which shows more clearly than did the negative the mottled appearance of the kidney pelvis

in the nephrectomized patients. H. Leiter reviewed 130 nephrectomies performed on my service for kidney malignancies and the pathological report showed that 50 patients had tumor thrombi in the main renal veins. Of these, 8 extended into the inferior vena cava. Naturally such extensions materially affect the prognosis. Despite such involvement of the renal veins, if one can remove the kidney and involved vein in one piece without forcing metastases into the circulation, one may occasionally eradicate the whole disease and effect a cure. In a few cases such tumor thrombi have been removed successfully from the cava and the patients have lived 5 to 14 years, when recorded, without further neoplastic disease being evident.

Recent studies have suggested that involvement of the renal veins may be recognized in the pre-operative study, although in general no definite diagnostic symptoms are produced by these renal vein or caval obstructions. During the last few years, in using excretory urography, it has been noted that a certain number of tumor cases fail to visualize on the side of the growth. The kidney shadow may show a

slight increase in density, but the calyces and pelvis show no traces of the excreted material. At first the reason for this seemed to be readily found in the more or less extensive destruction of the kidney and the compression of the calyceal and pelvic structures. Further study on a fair number of cases, however, failed to corroborate completely first impressions, and it became more and more evident that this failure to excrete and to visualize was associated often with renal vein tumor thromboses or perhaps, in rare cases, obstruction and compression of the venous system at the kidney hilus by unusually large or adjacently placed neoplasms. In reviewing 16 cases in which there was renal vein involvement, we found that 8 of these failed to visualize, whereas in 22 cases where the renal veins were empty, only 2 failed to visualize. Whether in the latter group this non-visualization phenome-



Fig. 13 Pyelogram with filling defect in the pelvis due to a large uric acid stone

non was due to more or less compression of the pedicle or torsion of it, cannot be said, as the possible correct interpretation of the non-visualization dawned upon me only about 12 months ago and such possibilities as direct compression or torsion were not noted in our records. It would, therefore, seem that before operation one is justified, in the absence of visualization in suspecting a renal vein involvement. At operation, the vascularity of the perirenal fat immediately suggests a disturbance in the renal return flow and the perirenal veins are practically regularly dilated and engorged when there is thrombosis of the renal veins or compression of them by the size of the growth or distortion of the pedicle.

The operative technique in such cases of renal vein thromboses should be associated with as little trauma as possible. We have found that section of the ureter, followed by exposure of the vascular pedicle, so that it can be carefully and gradually palpated to confirm the diagnosis, should be the first steps. Having recognized that the vein or veins are solid with tumor tissue a heavy chromic gut ligature is passed under the vein and so tied as to include all the other vascular structures in the pedicle. This part of the pedicle is sectioned, thus leaving the kidney hanging on its



Fig. 14 Pyelogram in which the whole upper pole of the kidney failed to visualize as the calyceal system was completely blocked by innumerable uric acid stones in the stenosed calyceal neck

thrombosed vein, which can readily be followed to the entry in the vena cava and ligated between the thrombus end and the cava before cutting across the renal vein at an uninvolved site. By this technique, the tumor is removed *in toto* in the kidney vein specimen. A Hyman has found that some of these patients have lived for 14 years following the operation apparently perfectly well.

If, on following such a thrombosed renal vein, exposed in the manner described, it is found that the thrombus protrudes into the cava, it may be possible gently to milk it back into the large renal vein and apply the ligature beyond it. In other cases, in which the involvement in the cava is more extensive, one had better cut across the renal vein after the vena caval wall is grasped and get the kidney out of the way. Then one can incise the cava using moderate pressure of a



Fig 15 Pyelogram showing filling defect due to blood clot

sponge on a long forceps below the entrance of the renal vein and gradually milk out the thrombus through an incision in the cava at the insertion of the renal vein, which really enlarges the orifice of this vein. If the intravenous thrombus is too adherent to be milked down to the incision, it may have to be scooped or pulled out. In one case, I introduced my index finger apparently into the right auricle and delivered large pieces of growth that I had not reached with the forceps. This particular patient was alive more than 2 years after this rather daring procedure, with a local recurrence in the lumbar gutter.

There is usually very little alarming bleeding, and the opening in the cava is readily closed with a few ordinary thin, plain catgut sutures. The suture line is compressed a few minutes until all evidence of ooze is controlled. It has been suggested that in those caval thrombi that invade the vein wall the latter should be resected. I have never attempted



Fig 16 A large retroperitoneal tumor displaces the ureter

such a procedure, and am inclined to question its advisability, as almost all such cases are probably doomed and too much surgery may bring discredit to our art and science.

PYELOGRAPHIC DATA

The introduction of opaque media by retrograde injection almost always helps in confirming the diagnosis. Unfortunately it is usually late in the disease and though confirmation is valuable, we cannot rely on pyelography to discern with any regularity early tumors, nor can we expect to pick up small, growing tumors frequently by repeated exploratory retrograde pyelograms. Pyelography frequently is the only absolutely diagnostic aid in a given case, though occasionally, induced traumatic bleeding, caused by manipulating the catheter and study of the imbedded cell washings, may assist in diagnosis. Retrograde pyelography is our greatest aid. The bizarre distortions, intrusions, dilatations, tractions



Fig 17 Retrograde pyelogram showing distention of upper pole of the kidney with displacement downward

on calyces and pelvis, are well known to all, but when they are of modest size and dimensions may be of doubtful interpretation. As the retrograde injection fills the organ under a certain degree of pressure, if flexibility is still present one may push a solid growth aside and rarely obtain a perfectly normal looking retrograde picture. To control such possibilities and to corroborate our studies we regularly do an intravenous excretory urogram first. This helps to locate the disease to rule out symmetrical renal disease, such as polycystic kidneys, and may call attention to typical deformities caused by a good sized neoplasm that cannot be seen in a retrograde pyelogram.

Non-opaque stones in the pelvis or calyces may produce hematuria and the filling defects in the pyelogram may cause difficulty in diagnosis. Multiple wax bougies, preferably using flexible whale bone bougies capped with a wax bulb, have helped us in excluding such uric acid stones. Blood clots may also cause suspicious filling defects. Repeated irrigations and repeated pyelographic studies may alone clarify the picture. Solitary cortical cysts,

carbuncles in the cortex, pressure from adjacent retroperitoneal masses, as in various adrenal tumors, or retroperitoneal sarcomas or hematomas may cause pyelographic deformities that baffle our interpretation. Perirenal insufflation by demonstrating the extrarenal tumors may clarify some of these cases. A careful history may do that for others, but at times only an exploratory operation will definitely establish the correct diagnosis.

Some of these kidney tumors masquerade as pyonephroses and as calculous disease and one must be watchful not to be led astray by roentgen and by pyelographic data which may suggest such pathology. When the patient comes to surgery one should always have in mind the possibility of a complicating neoplasm.

OPERATIVE TECHNIQUE

Nephrectomy, naturally, alone satisfies the indications. In the papillary type, nephroureterectomy is the operation of choice. As one gets more experience in this operative field, one is likely to do a nephrectomy, while at an earlier stage one would have done only an exploratory operation and closed the wound, saying that the case was inoperable. The more experienced viewpoint, however, can be justified by the fact that every once in a while such a nephrectomy may cure, may prevent local distress and pain, and may control severe bleeding with obstruction of the bladder with clots and other complications resulting from leaving the growth *in situ*. A Hyman calls attention to this change in procedure rather graphically. In 1927 in our series of 77 patients, operated upon, there were 9 exploratory operations and 68 nephrectomies, whereas in the next 58 adult cases, there were 56 nephrectomies and only 2 exploratory operations. With this change in viewpoint, our immediate postoperative mortality has nearly doubled. Whereas some years ago our mortality in nephrectomy for malignant kidney tumors was 7.4 per cent, according to A. Hyman's recent analysis of our series of 150 nephrectomies our mortality was 10.6 per cent. Of these, the transperitoneal nephrectomies had a mortality of 15 per cent and the lumbar nephrectomies 10 per cent plus.



Fig 18 Insufflation of the perirenal space shows Gerota's fascia lower part of cavity being filled by the kidney and the upper, under the diaphragm, showing air around the large pheochromocytoma or paraganglioma

The approach to the very large tumors is best obtained transperitoneally, as there is less trauma in delivering the tumor, the lumbar space being more limited. The theoretical advantage thought to inhere in the transperitoneal approach of early ligation of the vascular pedicle, experience does not altogether confirm. If a transperitoneal approach, through a long, mid rectus vertical incision, is made and the colon is mobilized by cutting the posterior parietal peritoneum, one comes down directly on the large tumor mass, but usually it covers the vascular pedicle so that this cannot be visualized. After doubly ligating the ureter, one can palpate the renal vessels and as the kidney is displaced laterally in its lumbar position, one can at times pass the finger under the vascular pedicle, feeling the aorta behind the finger, and then before lifting the



Fig 19 Oblique view of same case as in Figure 18

kidney out of its bed pass a heavy pedicle ligature about the vascular pedicle and tie it at the very beginning of the operation. Then after sectioning the pedicle beyond the ligature one can mobilize and deliver the kidney without danger of squeezing tumor cells into the circulation. When this is feasible it is the ideal procedure. Otherwise one must, after section of the ureter, deliver the kidney, until one reaches the vascular pedicle, and then ligate it under vision, much as one must do in the lumbar approach. The engorged perirenal veins bleed less in the transperitoneal approach, as one has the kidney out and its vessels controlled earlier than in the lumbar approach.

Most kidney tumors are removed by us through an enlarged lumbar incision, without rib resection, and depending on the renal vein involvement, the care of the vascular pedicle



Fig 20 Retrograde pyelogram showing moderate by hydronephrosis

varies. Here also early section of the ureter makes for easier delivery of the organ and one must not be alarmed by the engorged veins which can be pushed aside and their bleeding controlled by rapid delivery of the kidney. After disposing of the kidney, the perirenal fat should be removed. Frequently both the hypernephroid carcinomas and the typical carcinomas have perforated the kidney capsule and involved adjacent areas. After removal of all evidently diseased perinephric tissues, including involved peritoneum, it is advisable to soak the depths of the wound with 50 per cent alcohol pads to assist in destroying any local implants.

In the papillary growths of the kidney, as well as in tumors of the ureter, after ligating the vascular pedicle one should liberate the ureter without opening it down into the pelvis, below the iliac vessels, and then through a low rectus muscle incision, the freed ureter should

be identified and followed to the bladder. There it can be cut away with its ureter opening in this viscus, or it can be ligated close to the bladder and its lower intramural half inch can be electrocoagulated through the lumen as suggested by Colston. If cystoscopy shows a normal ostium, I have usually cystoscopically electrocoagulated the intramural part and then at operation tied the ureter as it enters the bladder. If the ostium is involved and cannot be controlled by electrocoagulation through the cystoscope I have excised a cuff of bladder surrounding the ureteral ostium. The lower end of the cut ureter is then covered with a sterile cot, firmly tied in place, and the kidney, with its whole ureter intact with attached finger cot, is lifted out of the lumbar wound, allowing of no spilling at any time during the operation.

END RESULTS

Despite all our efforts to diagnose and to cure these kidney neoplasms, our end results are far from satisfactory.

In the Wilms tumors, 5 year cures are most exceptional, and in our series we have only one adult who had a Wilms tumor and who has married, had children, and is well after 21 years. In children, almost all died within a few years. Of the 17 cases of nephrectomy collected by A. Hyman, 1 child has survived 6 years.

In the adult hypernephroid and carcinoma cases, our experience is much the same as in most clinics, and as late recurrences occur, one cannot speak of cures. According to A. Hyman's analysis, approximately half of those surviving the 3 year period succumbed before the end of 5 years. Apparently 34 per cent of our nephrectomized patients who survived operation were alive and apparently well after 5 years.

This sad outlook for patients with kidney tumors can be improved only by earlier diagnosis and better appreciation by the profession and laity of the significance of hematuria, lumbar pains, etc., and earlier recourse to simple excretory urography, which will point the clinician in the right direction. I feel sure this will lead to better end results in all large series of cases, as patients are certain to be brought

to the operating room at a period in their disease much nearer to its beginning than at the present time

The accompanying pyelograms are presented to show some of the diagnostic problems encountered in working up these kidney neoplasms. We have not included a long series to demonstrate the bizarre pictures produced by hypernephroid carcinoma and other carcinomas of the kidney, but for purposes of comparison, we present a number of pyelograms which illustrate the deformities produced by this type in adults and by the Wilms type in children

Under differential diagnosis, one must consider numerous local pathological conditions, which give more or less similar pyelographic pictures. Fortunately polycystic kidneys are usually bilateral, and though their bizarre pyelographic pictures often mimic tumors of the kidney, excretory urography or retrograde pyelography will usually rule out this condition. Solitary cyst of the kidney is usually easily differentiated pyelographically, as one can see not only the contour of the round cyst, but the deformity is more likely to be localized in one or more calyces

On the other hand, non opaque stones, uric acid in character, usually in the pelvis, produce definite filling defects, and simulate intrapelvic tumors or intracalyceal tumors at times. These can usually be excluded by passing wax bougies and obtaining definite scratch marks. Figure 13 shows a pyelogram with filling defect in the pelvis, due to large uric acid (non opaque) stone. Figure 14 shows a pyelogram in which the whole upper pole of the kidney fails to visualize, the calyceal system being completely blocked by innumerable uric acid stones in the stenosed calyceal neck, reaching into the calyces of the upper pole

Another pathological condition which may interfere with the pyelographic interpretation is the presence of blood clots in the pelvis or ureter. As the patient has been bleeding, in such a case as well as in the uric acid stone cases, the clinical picture is very suggestive of a neoplasm. To exclude these blood clot filling defects, regular irrigation of the pelvis and ureter, with frequent control pyelograms, will usually clarify the diagnosis, the blood clot



Fig 21. Definite filling defect in lower third of ureter, caused by papillary carcinoma of the ureter

being washed out and a normal uretero-pyelogram being obtained. Figure 15 shows such a filling defect, due to blood clot

Figure 16 shows a large retroperitoneal tumor displacing the ureter. Frequently these tumors are difficult to recognize. In this particular patient, the huge retroperitoneal tumor displaced the kidney upward, compressing the pelvic and calyceal structures and pushing the ureter to the opposite side of the spine, so that it was impossible to decide whether one was dealing with a tumor of the lower pole or an extrarenal tumor

Figures 17, 18, and 19 illustrate again how an extrarenal tumor may compress part of the calyceal system and give the impression of an intrarenal growth distorting this system. By perirenal insufflation it becomes possible to outline the kidney and demonstrate, as in this case, a large adrenal tumor, which compressed the upper pole and deformed the upper caly-

ces In Figure 17 the retrograde pyelogram shows the distention of the upper pole of the kidney with displacement downward In Figure 18 insufflation of the perirenal space shows Gerota's fascia, lower part of the cavity being filled by the kidney and the upper, under the diaphragm, showing air around the large pheochromocytoma or paraganglioma Figure 19 shows an oblique view of the same case, with the same relationship of the adrenal tumor to the kidney, with air under Gerota's fascia

Figure 20 is a pyelogram, retrograde, showing a moderate hydronephrosis which seems to be trapped as none of the opaque medium has come out alongside of the catheter into the ureter This patient had been subjected to stretching more than a dozen times for a ureteral stricture, and operation had been advised for infected hydronephrosis Complete study of the case, as shown in the ureterogram, Figure 21, shows definite filling defect in the lower third of the ureter, caused by a papillary carcinoma of the ureter, from which active bleeding took place at this examination, the patient never having bled prior to this exami-

nation The kidney and ureter were removed in one piece, as the ureter was fixed at the site of the tumor To avoid tearing into the lumen, one long incision was made, so as to get free exposure and complete removal of the ureter down to the bladder

NOTE.—Bearing on the lack of visualization in the roentgenograms of the kidneys during excretory urography, the following case published in the *Journal of the Mount Sinai Hospital* 1937, 3 242 is of particular interest

This female 50 years of age had bilateral hypernephromas with bilateral renal vein thromboses On November 20 1914 excretory urogram showed no visualization in either kidney On November 21 1935 cystoscopy showed good indigocarmine excretion from the right kidney in 4 minutes, and fair indigocarmine excretion from the left kidney in 6 minutes Retrograde pyelogram showed bilateral, moderate deformity of the calices, suggesting possibly polycystic kidney disease The blood urea nitrogen varied from 9 to 18 milligrams per 100 cubic centimeters.

The patient died January 1 1936 and autopsy showed that the left kidney contained a hypernephroma, occupying the middle third of the kidney and that the left renal vein was invaded by the neoplasm occluding completely its lumen by tumor tissue The right kidney presented a small, metastatic nodule The lumina of the larger tributaries and main stem of the right renal vein were partially occluded by soft thrombi etc

This remarkable case of non visualization on either side with normal blood urea and good indigocarmine excretion on both sides seems to be a confirmation of our previous observations incorporated in this article

GASTROSCOPIC OBSERVATIONS OF THE POSTOPERATIVE STOMACH

J B CAREY, M D, F A C P, Minneapolis, Minnesota

OPERATIVE procedures that are ordinarily performed upon the stomach for the relief of gastric or duodenal ulcer or the removal of carcinoma are often followed, sooner or later, by unfortunate consequences, the exact nature of which has not always been clear. The use of the flexible gastroscope offers the possibility of determining precisely the condition which is giving rise to such recurrent symptoms. Since this instrument has been developed and used, our knowledge of the exact morphological changes which are occurring in the stomach which is giving either a recurrence of symptoms similar to those experienced before the operation, some variations of them, or an entirely new set of complaints, has increased. With this information we are able to reclassify the more common conditions which cause those who have been operated upon to renew their gastric complaints.

In addition to the recognition of recurrence of ulcer or malignancy, formation of new ulcers (gastric, duodenal, jejunal, or stomal) and the presence of unabsorbed suture material, we may add gastritis. Of these, fistulas and at times ulcers and recurrent malignancy may be diagnosed by x-ray methods, but gastritis can be seen only with the gastroscope.

The gastritis which is seen in the stomachs of many patients who have had gastro-enterostomies or some type of resection with jejunal anastomosis was first clearly defined by Schindler. The types of gastritis are described as being in general similar to primary gastritis of the stomach, that is to say—superficial catarrhal, atrophic, and hypertrophic changes. But in addition, all of these changes are often seen in the same stomach in various degrees, so that Schindler has more recently decided that there must be a classi-

fication of "gastritis of postoperative stomachs."

It was Schindler who first pointed out that if the operatively produced opening did not rhythmically contract, gastritis was a consequence. Others (1, 2, 3, 4, 5, 6) have confirmed this statement. All of these gastroscopists have at various times made observations which may be summarized somewhat as follows. Whenever the stoma is too large or too small or poorly placed, changes in the gastric mucosa are likely to occur. Gastritis of various degrees is more commonly found following gastro-enterostomy than after any of the various methods of resection, and after gastro-enterostomy done for duodenal rather than for gastric ulcers. Most observers have described the hypertrophic form of gastritis with gastro-enterostomy and the atrophic form with resections. Schindler does not entirely agree. Stomal or jejunal ulcers are seldom or never seen in stomachs resected for malignancy. The more severe grades of gastritis occurring with a poorly functioning gastro-enterostomy seldom heal.

As to the reasons for the changes seen in some cases following operation, most of the workers suggest that, since a gastro-enterostomy, or even a resection, is a mechanical expedient only and not a physiological one, any slight deviation from a nearly normal physiological function of the stoma leads to dire consequences. That is, if the new opening in the stomach performs badly enough to allow not only regurgitation of upper intestinal secretions and contents into the stomach (which all of them do), but retention of these substances, an aggravation of the mucosa is initiated which may result in profound changes. A partial explanation for the effectiveness of gastro-enterostomy in relieving symptoms of ulcer and causing healing is that the inflowing alkaline substance from the intestinal segment neutralizes gastric

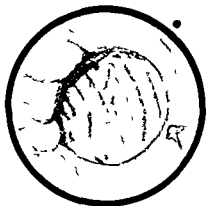


Fig 1 Case 4 Gastro-enterostomy opening with indurated upper edge and hemorrhagic spot on proximal edge



Fig 2 Case 4 Ulcerative gastritis with active ulcer at the site of the hemorrhagic area which was noted 1 month before

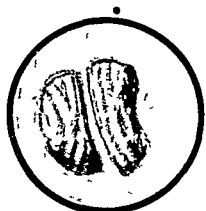


Fig 3 Case 11 Gastro-enterostomy—patent not contracting. The proximal edge is thickened and with superficial ulcers

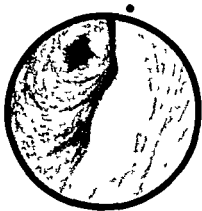


Fig 4 Case 12 Large gastro-enterostomy (right) separated from antrum (left) by high thick ridge. Jejunum shows more red than usual. Some granular change noted

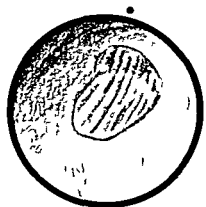


Fig 5 Case 13 Gastro-enterostomy on the posterior wall of the antrum. The gastric mucosa shows atrophic changes. There are inflammatory changes in the jejunum



Fig 6 Case 14 Double-barrelled gastro-enterostomy. The jejunum shows inflammation—it appears darker and redder than normal.

acidity This may be true for gastric ulcer, less evidently so for duodenal, but it is a nice question just how much of this reflux is sufficient for a benign result, and how much more may produce damage on its own account. The other part of the explanation, dealing with the sidetracking of the ingesta by a gastro-enterostomy, or perhaps simply hastening its progress from the stomach, may be helpful for duodenal ulcer, probably less so for gastric, but obviously this purpose may be defeated and actual augmentation of retention occur if the stoma cannot accomplish either of these events. It is certain that the atrophic gastritis seen in cases of gastro-enterostomy done for ulcer is a consequence of the operation, it is inconceivable that atrophy was present at the time of operation, such a condition being incompatible with ulcer. Probably the edematous, superficial, catarrhal gastritis with congestion and hemorrhage surrounding many gastro-enterostomy openings is the preliminary stage of a subsequent completely atrophic condition. The atrophic changes seen after partial resections of the stomach for malignancy might well have been present previous to operation, and persisted thereafter, possibly in an aggravated form. Although hypertrophic changes, even the more severe grades of hemorrhagic, erosive, and ulcerative gastritis, occasionally seen might well have resulted from a poorly functioning gastro enterostomy, such a condition could have been present before operation. That is to say, the condition for which the patient was operated upon may not have been ulcer, but chronic hypertrophic gastritis. Symptoms of the two conditions are often similar, and an x-ray film may show the only one of the numerous ulcers and erosions actually present which is deep enough or in such a situation as to cause a defect in the barium outline. For this reason it is advisable to examine gastroscopically all patients before operation.

Stomal ulcers are much more readily seen by the gastroscope than by x-ray. Often they are only erosions which will not produce any defect in the roentgen outline. Usually the stoma is surrounded by hyperrugation, scar tissue, contractions, and such other distur-

tions that interpretation of the irregularities of roentgen silhouette are notoriously difficult. Jejunal ulcers are obviously less easily seen with the gastroscope, although the condition of the mucosa may usually be estimated. In the stomach which has been resected for malignancy, the determination of recurrence is very difficult by roentgen methods. Such stomachs are distorted both by scar and perigastric adhesions. The mucosa is thrown into unusually distorted folds, so that the silhouette looks, even in the negative cases, very irregular. Unless the recurrent lesion is quite gross, mistakes are frequent. By the gastroscope, however, one is able to distinguish the normal from the abnormal effects and state with a fair degree of certainty the exact condition, whether normal, gastritic, or malignant.

Roentgen methods are indispensable in evaluating degrees of retention, the amount of reflux, the presence of the so-called "vicious cycle" and, in fact, all matters pertaining to motility—about which function gastroscopy indicates little. Fistulas of various kinds, ulceration in the jejunal loop beyond the vision of the gastroscope, and the condition of the duodenum itself, if it remains, are all better seen by the x-ray. As a matter of fact, in studying postoperative conditions, as in all other gastric investigation, the x-ray and the gastroscope are adjunctive methods, both are necessary.

It is sometimes possible to presume from the postoperative history what the condition may be. When no relief at all has been experienced following operation, either the original ulcer has not healed, or the condition was gastritis and not ulcer in the first place. When the symptoms recur soon after operation, either the original ulcer has become active again or a new ulcer of the stomach, duodenum, jejunum, or stoma has occurred. If there is a new ulcer of the duodenum or stomach, the history is identical with that preceding the operation. If the history is similar, but the location of pain and particularly the maximum pain point has changed—usually to the left instead of to the right of the midline and lower down—jejunal or stomal ulcer may be assumed. Symptoms occurring

late after operation, usually years, are set up by gastritis usually from the operation. The story of diarrhea indicating too large a stoma too near the greater curvature, or a fistula to the colon, is well known.

Most gastroscopists advocate the taking down of a gastro enterostomy if gastritis of any considerable degree is found. Henning seems not so sure of the efficacy of this procedure, although admitting that any attempt at other management is palliative and not curative. If the gastritis is well established and advanced, even taking down the gastro enterostomy may not result in complete healing, but it should prevent further progress of the disease.

The following patients were examined gastroscopically because of the presence of symptoms (except Case 2) and in all of them some condition was found to explain the complaints or abnormalities noted by x ray examination.

CASE 1 No 64106 Male aged 77 years with complaint of vomiting. X ray diagnosis chronic hypertrophic pyloric stenosis. No free hydrochloric acid in gastric secretion.

Gastroscopy carried out February 20, 1936 revealed a generalized atrophic gastritis funnel like antrum with small pin point, immobile pylorus. There is a small pearly, millet seed projection on the pyloric sphincter—the exact nature of which was undetermined.

Operation was performed March 4, 1936. Gastric resection was done. The sections examined microscopically showed some hypertrophy of the pyloric musculature. The sections from the body of the stomach were poor, being badly torn, but an atrophy of the mucosa could be seen whether inflammatory or not was indeterminable. Nothing like the tiny pyloric 'seed' noted gastroscopically could be identified. (Note this may have been a fleck of barium saturated mucus.)

Roentgen examination after operation showed a non functioning opening in a resected stomach.

Gastroscopy carried out May 22, 1936 showed a small stomach pouch with a good sized stoma at the distal part on the posterior wall. The proximal edge of this stoma appeared edematous and puckered. Surrounding the opening was superficial catarrhal gastritis with a few submucous hemorrhagic spots. The other parts of the stomach showed atrophic changes as before operation.

CASE 2 No 619057 Male, aged 59 years has had an x ray diagnosis of gastritis but he has no symptoms. He had a perforated gastric ulcer closed many years ago. Gastroscopy was carried out February 20, 1936, and showed on the anterior

wall of the stomach a slit or deep crevasse surrounded by high coarse redundant folds puckered toward the defect, but no inflammatory changes were revealed.

The x ray diagnosis of gastritis was made undoubtedly because of the hyperregeneration consequent upon the scarring at site of closure of perforation.

CASE 3 No 627911 Male, aged 46 years. A diagnosis of duodenal ulcer had been made, for which a gastro enterostomy was done in 1918. Because of recurrent hemorrhages, in 1935 a resection was done leaving the original gastro enterostomy opening but symptoms, principally hemorrhagic persisted and in 1936 a further resection was done, this time the old gastro enterostomy being taken down and a new opening being made. Gastroscopy was carried out March 6, 1936. The gastric cavity was small. The distal part showed hyperregeneration probably scar contracture at the site of resection. The extreme distal part, on the greater curvature had a round crater like appearance with a ridge of mucous membrane surrounding it. The area looked like an ulcer crater except that it was so even and the floor was dark. The mucosa showed generalized hypertrophic gastritis. On the posterior wall an open stoma was seen surrounded by coarse hypertrophic rugae.

Gastroscopy was carried out December 20, 1936, and showed again a small stomach cavity with generalized hypertrophic changes of the mucosa. The stoma was seen on the posterior wall near the greater curvature, without any puckering of the mucosa but with an even edge.

CASE 4 No 644578 Male aged 63 years, had a clinical diagnosis of perforated ulcer 20 years ago and 3 years later a gastro enterostomy was done. Roentgenogram now showed a well functioning gastro enterostomy, but 5 per cent retention and a very short lesser curvature.

Gastroscopy was carried out March 25, 1936, and showed a small pylorus in the normal position and contracting normally. A gastro enterostomy opening in the posterior wall of the antrum showed occasional contracture. On the proximal lip there was a submucosal hemorrhagic erosion. The distal edge was rather thick. There was a generalized hypertrophic gastritis, and on the anterior wall opposite the gastro enterostomy was a rather large submucous hemorrhagic area, and near it scar of old healed ulceration. (See Fig 1.)

Gastroscopy was again carried out April 24, 1936. The gastro enterostomy opening seemed to be more actively contracting than before. The submucous erosion on the opening was now only a pigment spot. The submucous hemorrhagic area previously seen on the anterior wall opposite the gastro enterostomy was now a definite ulcer, with grey green exudate in the crater. The gastritis in general seemed worse. (See Fig 2.)

From the gastroscopic findings it would seem that this was a case of hypertrophic ulcerative gastritis from the beginning

CASE 5 No 624,553 Female, aged 37 years, had a chronic duodenal ulcer. Gastro enterostomy was done some years ago. It is now supposed to be a gastric ulcer, gastrojejunal ulcer, or recurrent duodenal ulcer. She has had repeated hemorrhages.

Gastroscopy was performed April 24, 1936, and showed an extreme hook shaped stomach, so could not see presumed site of gastro enterostomy on the posterior wall of the antrum beyond angulus, the angulus being too deep. The pylorus itself was normal. The antrum, that part of it which could be seen, was normal except for a single polyp on "floor." The mucosa everywhere was normal, so presumably the gastro enterostomy (if present) was functioning well.

This case illustrates the difficulty encountered in this type of stomach in visualizing the lesser curvature and posterior wall of antrum beyond the deep fold of the angulus.

CASE 6 No 625024 Female, aged 50 years. The history showed migraine, 1920, cholecystectomy, 1926, resection for cancer of the stomach, 1927, radium application for squamous cell cancer of the cervix, 1935. January 1936, roentgenogram showed the stoma in the resected stomach functioning well. No mention of any recurrence.

Gastroscopy was carried out April 29, 1936, and revealed a small distorted stomach. The resected end with rather small stoma was seen hidden in the deep mucosal folds. The wall of the stomach was everywhere involved in malignant change—pearly white, nodular appearance.

Patient died with pneumonia May 2, 1936.

CASE 7 No 633,377 Male, aged 58 years. Gastric resection for cancer of the pylorus was performed December 18, 1934. In April, 1936, roentgenogram showed defect on the lesser curvature.

Gastroscopy was carried out April 27, 1936, and showed a small distorted stomach. The stoma was seen at the distal end contracting well, sometimes opening widely so that the jejunum could be visualized. The mucosa was generally atrophic throughout. On the anterior wall toward the lesser curvature was a nodular elevation, greyish white on top, characteristic of malignancy.

This patient died August 4, 1936.

CASE 8 No 617,528 Female, aged 44 years. A gastro enterostomy had been made 20 years ago. She was operated upon again in 1928 at which time cholecystectomy was performed and "something was done to stomach."

Gastroscopy was carried out July 24, 1936, and revealed a very small stomach. The pylorus was

not seen, nor anything that could be identified as antrum which had probably been resected. There was a very large opening into the jejunum on the anterior wall, near the greater curvature, which was separated on the proximal side from the stomach proper by a very thick, edematous ridge or fold of the stomach wall. The distal part of the opening could not be plainly made out, but seemed to shade off into a deep crevasse. The mucosa everywhere was pale, thick, granular, edematous. The jejunum also showed evidences of inflammation.

From the location and size of this opening, one would suppose that there was at the same time too rapid emptying of gastric contents, and considerable reflux.

CASE 9 No 651,382 Male, aged 47 years. Patient had had a gastric operation for ulcer. The roentgenogram showed a well functioning gastro-enterostomy.

Gastroscopy was carried out August 21, 1936, 2 days after barium examination and vision was partially obscured by the barium which remained in the stomach. The pylorus was not identified, but the gastro enterostomy opening was seen on the posterior wall of the antrum. The mucosa looked normal. Gastroscopy should be repeated after the barium has been eliminated.

This case indicates the necessity of waiting 3 or 4 days after barium has been used before doing gastroscopy.

CASE 10 No 647,568 Female, aged 59 years. Gastro enterostomy had been done 18 years ago. She has pain at 3 00 a m and 7 00 p m.

Gastroscopy was carried out August 21, 1936. A very large gastro enterostomy opening was noted on the posterior wall of the antrum. The jejunum was visualized and was normal in appearance. The mucosa of stomach was everywhere normal. The symptoms in this case may be caused by a recurrence of the duodenal ulcer, or a too rapid emptying because the stoma is so large.

CASE 11 No 11,764 Female, aged 44 years. Gastro enterostomy had been done for duodenal ulcer, 10 years before. She has lately had "ulcer" symptoms recur.

Gastroscopy was done April 9, 1936. The pylorus was seen to be normal and contracting normally. The gastro enterostomy opening was located on the posterior wall of the antrum some little distance from the pylorus. The opening was quite large and did not contract. The proximal edge was thick, apparently edematous, and had two small greenish erosions. No ulcerations of jejunum were seen. (See Fig 3.)

This patient was not examined by x-ray, but it is doubtful whether these small erosions could have been seen in thick edge of stoma.

CASE 12 No 25817 Male aged 42 years
Gastro enterostomy was done 10 years before for perforated duodenal ulcer

Gastroscopy was performed September, 1936
The antrum appeared to be shrunken and was inactive The gastro enterostomy opening was located on the posterior wall of the antrum and was separated by a deep ridge or fold from the antrum proper The opening itself was very large The jejunum could be seen and showed some granular change The proximal edge of the gastro enterostomy shaded off into the gastric mucosa The body of the stomach showed granular change with some exudate and a few small hemorrhages (See Fig 4)

CASE 13 No 57,936 Female, aged 44 years
Gastro enterostomy was done 12 years ago for duodenal ulcer The roentgenogram shows practically non functioning gastro enterostomy

Gastroscopy was carried out October 23 1936
The gastro enterostomy opening was located on the posterior wall of the antrum rather high up near the lesser curvature The stoma was small and did not contract The edges were thin and rigid The jejunum seen through the opening showed inflammatory change The pylorus was out of normal position The antrum showed granular gastritis most marked around the stoma with some atrophic change also The body of the stomach showed mixed granular and atrophic changes with some areas of submucosal hemorrhage (See Fig 5)

This gastro enterostomy was taken down
At the time of operation, the conditions were found as represented The opening was small and fixed, the jejunal loop was kinked up at the site of the opening No indications of supposed previous duodenal ulcer were seen It was for this reason that the stoma was closed and the original natural conditions were restored

CASE 14 No 49671 Female aged 38 years
Gastro enterostomy was done September, 1933, for chronic duodenal ulcer with obstruction In October, 1936 patient had hemorrhage

Gastroscopy was done November 17 1936 The pylorus seemed normal The antrum showed some patches of adherent mucus The gastro enterostomy opening on the posterior wall of antrum was double barrelled with a wide septum The jejunal mucosa was distinctly hemorrhagic, especially that seen through the proximal opening The body of the stomach showed some superficial gastritis and an occasional hemorrhagic spot (See Fig 6)

In the absence of any lesion in the stomach which looked as though it had been responsible for the hemorrhage and the definite evidence of jejunal inflammation of hemorrhagic type, the assumption was that the hemorrhage

came from jejunitis, probably ulcerative in character

CASE 15 No 617,859 Male aged 27 years
Gastro enterostomy was done in June, 1935, for perforating ulcer Roentgenogram now shows poorly functioning gastro enterostomy and 10 per cent residue

Gastroscopy was done December 2, 1936, and revealed a pylorus somewhat out of position, the antrum narrowed The gastro enterostomy opening was far down on the greater curvature about the region of the angulus—a poor place The body of the stomach showed a thickened congested mucosa with excess mucus and secretions The stomach was very intolerant to air

In this case it is rather obvious that the gastro enterostomy, on account of its poor position, is responsible for the gastritis present

CONCLUSIONS

Gastroscopy offers the only opportunity of seeing directly such changes in the gastric mucosa as are likely to result from a poorly functioning opening placed in the stomach as part of some operative procedure upon it These changes include various types and degrees of gastritis and ulceration, and recurrence of malignancy

Because of the similarity of symptoms and often of roentgen findings between peptic ulcer and chronic hypertrophic gastritis, it is suggested that gastroscopy should always be done in such cases before operation

BIBLIOGRAPHY

- 1 GUTZEIT K Die Bedeutung der Gastroskopie Verhandl d deutsche Gesellsch f inn Med 1935 47 368
- 2 Idem. Ueber die Ergebnisse der Gastroskopie Med Klin 1933 29 965
- 3 Idem Die Gastroskopie im Rahmen der klinischen Magendiagnostik Ergebn der inn Med u Kinderh 1929 35 1
- 4 HENNING N Ueber die Gastritis nach Magenoperationen Zentralbl f inn Med 1928 54 578
- 5 HERTEL E and KALLIUS H A Arch. f klin Chir 1928 151 578
- 6 MOUTIER F Traite de gastroscopie chap 18 Paris Masson et Cie 1935
- 7 SCHINDLER R Lehrbuch und Atlas der Gastroskopie Munich J F Lehmann 1923
- 8 Idem Zentralbl. f Chir 1926 53 2959
- 9 Idem On the clinical value of gastroscopy Proc Staff Meet Mayo Clin 1936 2 738
- 10 Idem Personal communications
- 11 SCHINDLER R and ORTMAYER M Classification of chronic gastritis Arch Int. Med 1936 57 959

BLOOD PRESSURE IN SKIN CAPILLARIES AND SURGICAL SHOCK

G SZÁNTÓ, M D, Budapest, Hungary

FOR many years much attention has been directed toward the effect of surgical operations on the human organism. Many questions still remain unanswered concerning the response of the individual organs and concerning the physical and chemical changes occurring in the body fluids brought about by the trauma of operation. The effect of surgical operations on blood pressure is well known (Koenig). In our investigations we have been able to confirm the premise that blood pressure invariably falls after operation, especially after extensive manipulations of the mesentery and the peritoneum. The type of anesthesia and the extent of the operation are most important factors involved in the production of a fall in blood pressure. My own investigations, which were carried out in collaboration with Findeisen, concerned the effect of operations upon the vegetative nervous system and have caused me to note particularly changes in capillary pressure.

Blood pressure in the arteries and in the capillaries is regulated by different hemodynamic mechanisms. When vasomotors are mentioned, the arteriomotors are generally thought of (Krogh), on the other hand, our ideas as to the co-ordinated but rather independent capillariomotor system, however, are more sketchy in spite of the fact that in surgery the importance of the latter is by no means less than that of the former. The changes so often observed in patients after operation are familiar to every surgeon: paleness of the face and lips, slight cyanosis, soft, running pulse, a feeling of weakness almost to faintness. These symptoms are generally thought to be due to surgical shock, even though there seems to be no clear cut idea as to just what surgical shock really is. It is my purpose to discuss as an important

part in causing surgical shock the changes in blood pressure in the capillaries of the skin. In my investigation I have tried to determine the effect of capillary pressure in the production of surgical shock independent of the part played by chemical, nervous, mechanical, secretory, or other stimuli which may be involved.

There are many methods by which the blood pressure in skin capillaries may be determined, and the results are often rather contradictory. With the Recklinghausen method as a basis the normal capillary pressure is supposed to be 750 millimeters of water, with the Basler method, 70 to 110 millimeters, with the Goldmann method, 85 millimeters, with the Nevermann, 75 to 150 millimeters. Aside from measurements made with the capillary microscope (Stern and Hirsch), the methods most often used are those of Kohn and Rajka, the latter having devised a special apparatus. In my study, I used a simple but dependable method which was suggested by Herzog. The apparatus is connected to a mercury manometer which allows regulation of pressure at will. This device is applied to the fingers and a record is made of the minimal pressure at which the small vessels in the arterial supply area of the digital arteries are unable immediately to overcome the resistance. Further applications of the device are made, the manometer pressure is lowered and records are made of the minimal pressure at which the finger becomes immediately flushed. This reading will correspond to the resistance of the capillary bed. As can be readily seen this method does not immediately measure capillary pressure but indicates the resistance of the capillaries to the inflow of blood. According to Herzog, the normal capillary pressure in healthy individuals varies between 40 and 50 millimeters of mercury.

At the Second Surgical Unit of the University of Budapest, the capillary blood

From the Second Surgical Unit of the Royal Hungarian Petrus Pázmány University of Budapest. L. Bakay, M.D., professor of surgery, director.

TABLE I—MINOR OPERATIONS PERFORMED UNDER INFILTRATION ANESTHESIA

Case Age and sex	Diagnosis	Pre-operative pressure		Postoperative pressure							
				4 to 6 hours		1st day		3rd day		5th day	
		Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial
1 32 F	Chronic appendicitis	45	115	45	105	42	115	45	115		
2 16 F	Chronic appendicitis	40	120	40	110	38	120	38		40	
3 27 F	Chronic appendicitis	40	125	35	115	40	115	40	115	40	
4 22 F	Chronic appendicitis	44	120	44	120	44	120	44			
5 42 F	Chronic appendicitis	50	115	50	110	50	110	50			
6 41 M	Chronic appendicitis	35	110	35	110	35	100	35	110		
7 28 M	Chronic appendicitis	35	120	35	110	35	115	35			
8 26 M	Chronic appendicitis	40	125	40	115	40	120	40			
9 40 M	Chronic appendicitis	45	130	45	125	45	120	45	125		
10 29 F	Chronic appendicitis	35	110	35	105	35	110	35			
11 41 M	Hernia	35	140	35	140	35	130	35	140		
12 30 M	Hernia	35	130	35	125	35	110	35	115		
13 46 F	Hernia	40	130	40	130	40	125	40	12		
14 45 F	Hernia	45	140	45	140	45	130	45	135		

pressure of 80 individuals was determined before operation, after operation, and during the following 4 to 5 days. Measurements were also made at the same time of the blood pressure in the brachial artery. The cases were all current surgical material. They are summarized in Tables I to IV, as follows: (1) Those in which minor operations were required—appendectomy, herniorrhaphy, operations for hydrocele, and so on—performed under infiltration anesthesia, (2) gall bladder operations, (3) gastrectomy for ulcer performed under infiltration anesthesia, and (4) other laparotomies and miscellaneous major operations. Response in cases in the first group was so uniform that only a few typical cases are shown in Table I.

In the first group no postoperative change in capillary pressure could be observed either in several hours or a day after the operation, with the exception of 3 cases. The addition of epinephrin to the anesthetizing solution—procaine—had no effect whatever. In the 3 instances mentioned, there was some postoperative fall in the capillary pressure. The postoperative fall in arterial pressure was normal. This demonstrates the fact that capillary pressure may remain uninfluenced by a fall in arterial pressure. We wish to

stress the great stability of capillary pressure, as shown by the fact that factors which caused a marked lowering in arterial pressure did not cause a fall in capillary pressure.

In the second group (Table II) the operations were performed under ether inhalation anesthesia. With the exception of 2 cases there was a fall in capillary pressure after operation amounting to 5 to 15 millimeters of mercury. The first measurement was made 6 hours after operation and the measurements were repeated several times in the next 4 days. In most cases there was a concurrent fall in the arterial pressure, in a few instances, however, the decrease in capillary pressure preceded the fall in arterial pressure. In some cases the capillary pressure fell as early as 6 hours after operation, whereas the arterial pressure did not start to fall until the next day. The fall in capillary pressure was invariably associated with a fall in arterial pressure. On the third to the fifth day both the capillary and the arterial pressures rose to their normal levels.

In Table III are shown the cases in which operations were performed under infiltration anesthesia. The extent of the operation and the length of time for its performance were sufficient to account for a marked degree of

TABLE II—GALL BLADDER OPERATIONS—CHOLECYSTECTOMIES—PERFORMED UNDER ETHER INHALATION NARCOSIS

Case age and sex	Pre-operative pressure		Postoperative pressure							
			4 to 6 hours		1st day		3rd day		5th day	
	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial
1 38 F	45	130	35	120	35	125	40	130	45	130
2 45 F	45	135	35	125	35	135	45	130		
3 46 F	35	125	25	100	35	110	35	125		
4 33 F	35	120	25	115	30	110	35	110		
5 52 F	40	130	35	115	30	130	40	130	45	
6 50 F	45	140	40	130	30	130	35	130	45	
7 52 F	45	130	40	130	35	135	35	150	45	
8 45 F	35	130	20	130	20	90	20	120	35	
9 41 F	45	118	35	115	40	115	40	120		
10 43 F	35	130	25	110	20	110	35	125		

TABLE III—GASTRECTOMIES FOR ULCER PERFORMED UNDER INFILTRATION ANESTHESIA

Case age and sex	Pre-operative pressure		Postoperative pressure							
			4 to 6 hours		1st day		3rd day		5th day	
	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial
1 30 M	35	115	25	115	20	100	30	110	35	115
2 37 M	30	110	20	105	10	105	25	110	30	110
3 26 M	30	115	25	120	30	120				
4 55 M	30	115	22	100	20	100	25	110	30	115
5 51 M	35	120	35	100	35	105				
6 31 M	30	110	20	95	20	95	25	100	30	110
7 33 M	32	110	25	85	20	80	15	95	30	105
8 30 M	35	115	25	100	20	95	25	110	35	

shock, causing lowering of capillary pressure. In 8 cases partial gastrectomies were done after the Bullroth II method and combined abdominal wall and Braun splanchnic infiltration anesthesia was used. In all cases the pre-operative pressure was found to be near the lower limit of normal values—which can be explained by the fact actually observed in my patient, that the lower arterial pressures prevail in vagotonic ulcer patients. In all but 1 case the capillary pressure showed a decrease which was observable as early as the afternoon of the day of operation. This decrease amounted to 5 to 10 millimeters of mercury. The absolute decrease is less than that in the cases shown in Table I. If, however, the proportional decrease is calculated, it proves

to be of approximately the same magnitude. Synchronism in the changes in arterial and capillary pressures is often observed.

In Table IV are tabulated the cases in which laparotomies were performed to relieve peritoneal adhesions and as well other miscellaneous major operations. After laparotomies under infiltration anesthesia the capillary pressure fell, just as it did after gastrectomies. A marked decrease in capillary pressure occurred after the amputation of a limb performed under inhalation anesthesia, in a craniotomy for the removal of a cerebellar tumor which was performed under local anesthesia, and in 1 case of bleeding gastric ulcer. Marked fall in capillary pressure was noted on the second day after operation. The bleeding

TABLE IV—MISCELLANEOUS OPERATIONS, PERFORMED UNDER ETHER INHALATION NARCOSIS

Case age and sex	Diagnosis	Pre-operative pressure		Postoperative pressure							
				4 to 6 hours		1st day		3rd day		5th day	
		Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial	Capillary	Brachial
1 50 M	Adhesions	30	112	30	105	30	110				
2 38 M	Adhesions	40	120	25	105	35	100	40	120		
3 36 M	Stomach cancer	40	130	30	110	40	120				
4 48 M	Stomach cancer	40	135	30	110	35	115	35	130		
5 42 F	Cerebellar tumor	40	145	40	120	20	80	25	110	40	140
6 38 M	Hematemesis	25	110	20	105	15	95				
7 59 F	Cancer of breast	40	160	40	115	35	145	40	150		
8 50 F	Cancer of breast	50	165	50	150	40	140	45	150	50	150
9 45 F	Myoma uteri	40	120	30	115	30	105	40	110		
10 17 F	Amputation cruris	35	110	25	95	25	95	35	105		
11 18 M	Amputation cruris	40	120	35	110	20	95	35	120		

ulcer terminated fatally in spite of repeated blood transfusions, capillary pressure fell continuously and progressively until death ensued. In no case were we able to record a pressure below 15 millimeters of mercury. Neither the herniorrhaphy nor the radical amputation of the breast affected the capillary pressure. It has been demonstrated by Blalock, Ewig Klotz, Beard and Johnson, that surgical shock is associated with lowered blood pressure. That the capillary system is relatively independent of the arterial system is positively warranted by my studies of the effect of operative trauma on capillary pressure. Any major surgical operation produces many factors which affect the function of the capillary system, and it is difficult to disentangle one such factor from the other.

First, as to nervous regulation, the sympathetic innervation of the capillaries is brought to mind. Stimuli acting on the peripheral nerves may have a prompt effect on the capillaries. Sudden circulatory collapse during an operation may be brought about also by stimuli acting on the central nervous system. If a rabbit is frightened, the capillaries of its ears may show a marked reaction, which is easily observed (Krogh). During operation, ample occasions may arise for the occurrence of such psychic vasomotor reflex phenomena. Both fear and pain may affect the vasomotor system via the central nervous system.

Second, chemical substances which act on the capillaries may be mentioned. Such substances are formed in all surgical operations. Trauma incident to any operation destroys tissues and causes the death of many cells so that disintegration products, albuminoid compounds, are liable to enter the blood stream. It is a well known fact that after tissue injury, histamine like substances are liberated which play a significant part in the production of shock. The concept of a "capillary poison" is credited to Heubner. The effects on the circulation produced by the intravenous administration of histamine have been described by Dale and Laidlow. Injection of histamine causes a fall in blood pressure and the dilatation of capillaries. The reports of the Medical Research Committee on Surgical Shock emphasize the role of capillaries in the production of circulatory failure. A vicious circle is established. First there is a toxic paralysis of the capillaries followed by progressive circulatory failure. This in turn causes anoxemia of tissues and a decreased supply of vasomotor hormones to the tissues, and finally the vessels become increasingly dilated. Therefore, a decrease in capillary pressure after operation is but an indication of the presence of surgical shock.

Third, the effect of the anesthetic agents on the capillaries, an equally important factor, should be stressed. Dale and Laidlow, in their

paper on histamine shock, point out that in narcotized animals shock is prone to occur quickly and in a particularly serious form. The effect of inhalation anesthesia on blood pressure depends on its depth and duration. The effects of histamine and the narcotizing agent do not seem to be simply superimposed on each other, their relation seems to be more one of synergetic activation (Krogh).

Finally, I wish to mention postoperative acidosis, a factor which, too, is liable to have an effect on capillary pressure. In his studies, Fleisch found that it is possible to cause a decrease in capillary pressure by injecting acidulated solutions into the vessels of animals.

The methods used to combat the pathological decrease in capillary pressure after operation are the same as those for surgical shock. The use of drugs which raise the tonicity of peripheral vessels—caffeine, strychnine, epinephrin—and as well the administration of isotonic—preferably colloidal—solutions are the most rational forms of therapy. These methods are useful in surgical shock as well as in decreased capillary pressure caused by the dilatation of the capillaries.

SUMMARY

Blood pressure in skin capillaries, as measured according to the method of Herzog,

was found to be lowered after certain operations. Appendectomy, herniorrhaphy, minor operations performed under infiltration anesthesia did not cause appreciable change in capillary pressure. Major abdominal operations, which were performed under either local or inhalation anesthesia, caused a fall in capillary blood pressure which was concurrent with a lowering in arterial pressure. The decrease in pressure is noticeable as early as 4 to 6 hours after completion of the operation and the pressure returns to normal within 3 to 5 days later.

Decreased capillary pressure may be regarded as a component part of surgical shock.

Stimuli which cause dilatation of the capillaries are (1) nervous impulses, (2) tissue disintegration products—histamine-like substances, (3) anesthetic agents, (4) shift of the reaction of the blood toward acidity.

The treatment of decreased capillary pressure and surgical shock should be along identical lines.

REFERENCES

- 1 BASLER Arch f d ges Physiol, 1902, 147 375
- 2 DALE and LAIDLAW J Physiol, 1910, 52 355
- 3 GOLDMAN Arch f d ges Physiol, 1914, 159 51
- 4 HERZOG Deutsche Arch f klin Med, 1920, 104 108
- 5 HESS, W R Beitr z klin Chir, 1921, vol 122
- 6 HEUBNER Klin Wchnschr, 1923, No 44, 2015
- 7 KLINGMUELLER Ztschr f exper Med, 1925, 47 244
- 8 KROGH Anatomie und Physiologie der Capillaren Berlin, 1924
- 9 RECKLINGHAUSEN Arch f exper Path 1906, 55 375

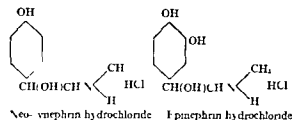
NEO-SYNEPHRIN HYDROCHLORIDE IN THE TREATMENT OF HYPOTENSION AND SHOCK FROM TRAUMA OR HEMORRHAGE

CARL A. JOHNSON, M.D. Chicago, Illinois

THE hemodynamic drugs commonly used in the treatment of the hypotension of shock from trauma or hemorrhage are epinephrin, ephedrin, and neo synephrin hydrochloride. A preliminary report of the use of neo synephrin hydrochloride as an adjunct in the treatment of shock was made in July, 1936(2). That report also contained the results of numerous studies on the pharmacology of the drug. Earlier studies on the pharmacology had been made by Kuschinsky and Oberdisse (3) in Germany, and by Tainter and Stockton (5) in this country. Since the first report, 52 additional patients with hypotension following trauma or hemorrhage have been treated with the drug and this paper is a brief summary of the reports.

Neo synephrin hydrochloride is a synthetic drug closely related structurally to epinephrin and ephedrin. Pharmacologically, some of its actions are different and from the point of view of this study the chief differences are:

1. The structural formula of neo synephrin hydrochloride as compared with epinephrin hydrochloride is as follows:



2. The subcutaneous injection of neo synephrin hydrochloride causes a marked and sustained rise in blood pressure, i.e. 1 cubic centimeter of a 10 per cent solution subcutaneously causes a rise which usually lasts from 1 to 2 hours. Epinephrin subcutaneously

does not uniformly cause a rise in blood pressure.

3. In the patients studied, neo synephrin hydrochloride did not produce extra systoles or abnormal rhythms, as may occur with ephedrin or epinephrin. The evidence of abnormal mechanisms is an important consideration.

4. It causes a slowing of the heart rate while ephedrin and epinephrin increase the heart rate.

5. It does not cause nervousness, or palpitation, both of which are common complaints with ephedrin or epinephrin.

6. Neo synephrin hydrochloride has a very wide margin of safety as compared with ephedrin. The fatal dose of neo-synephrin hydrochloride in the dog when given intravenously in divided doses is about 250 milligrams per kilogram, while the fatal dose of ephedrin intravenously as determined by Chen is 70 to 75 milligrams per kilogram of the dog. The fatal dose of epinephrin in the dog when given intravenously is 0.1 to 0.6 milligrams per kilogram (4). It is well known clinically that small doses of the epinephrin may produce alarming symptoms.

The material studied were patients who were under treatment at St. Luke's Hospital, the University of Illinois Research Hospital, and at Passavant Hospital Chicago, which included the following types of cases:

(1) surgical patients in which hypotension with or without shock occurred during or after surgical procedures. (2) patients with hypotension with or without shock following traumatic injuries. (3) patients in whom the drug was used as a prophylactic against the vascular depression which often occurs during spinal anesthesia. In addition it was also used in a number of patients to restore the blood pressure which occasionally falls preceding

operations on the gasserian ganglion as a result of the upright posture, nervous apprehension, etc. This vascular depression often occurs before any operative procedure has been started.

The first group included 16 genito-urinary patients, 10 orthopedic cases, 7 neurological patients, 7 general surgical patients, and 3 obstetrical and gynecological patients. The operations are listed in Table I.

TABLE I—TYPES OF CASES

Genito-urinary patients

Operation	Number of patients
Transurethral resections	7
Prostatectomies	3
Nephrectomies	3
Stricture of the urethra	1
Bladder resection for carcinoma	1
Removal of tumor or prostate	1

Orthopedic patients

Spinal fusions	4
Incision and drainage of osteomyelitis	3
Laminectomies	2
Hip Shelving	1

Neurological patients

Operations on the brain and spinal cord	7
---	---

General surgical patients

Abdominal laparotomy for sarcoma	1
Gastric resection	1
Resection of 3 feet of bowel for strangulation	1
Cholecystogastrostomy	1
Carcinoma of rectum	1
Radical breast amputation	1
Teratoma of spine	1

Obstetrical and gynecological patients

Abruptio placentae with severe hemorrhage	1
Inverted uterus following delivery	1

The second group of patients were those who developed hypotension following accidental injuries. Of the 9 patients treated, 4 followed automobile injuries, 2 fell from 40 and 60 feet, respectively, 1 was struck by a steel plate, and 2 were shot during holdups. All of these patients had multiple fractures except the 2 who were shot in the chest.

Of the third group of patients 5 were given the drug to prevent the vascular depression which commonly occurs during spinal anesthesia, and 11 were given the drug to restore the blood pressure and prevent fainting which may occur preceding operations on the gasserian ganglion as a result of the patient being in the upright posture, apprehension, etc.

Finally, one patient was given neo-synephrin hydrochloride during a treatment with foreign protein in which an alarmingly low blood pressure developed. The drug did not cause the usual rise in blood pressure during the period of anaphylactic shock. The studies upon 4 patients which were proved at autopsy to have generalized peritonitis, which may be classed as a toxic shock, gave somewhat similar results on the blood pressure. The differences between the action of the drug in toxic shock as compared to its action in the other surgical cases with hypotension with or without shock, suggest the futility of attempting to carry over experimental results from one type of shock to the other as, in all probability, the mechanisms of the two types of shock are different.

The average dose of the drug given was 5 to 10 milligrams subcutaneously and repeated if necessary. The blood pressure was taken every 20 minutes until it was certain that the blood pressure would sustain itself. The number of doses necessary to accomplish this varied from a single dose to 23 doses. The treatment is illustrated by 6 detailed case reports which follow.

In the series of 52 patients where the hypotension followed operations or injury, there were 10 deaths with postmortem examination in 7. Of these 7, 4 died of generalized peritonitis, 2 of uncontrolled hemorrhage, and 1 from hemorrhage and shock. Of the 3 remaining patients on whom autopsies were not obtained, the clinical causes of death were multiple fractures, hemorrhage, and shock.

It should be mentioned that neo-synephrin hydrochloride did not slow the heart rate in patients with shock, as is a common result in normal unanesthetized patients. Also, it did not increase the heart rate.

EVALUATION OF STUDY

The presence of shock from trauma or hemorrhage is often difficult to determine. There are several objective findings usually listed as being present in shock such as low blood pressure, rapid and thready pulse, prostration, etc., but even though these findings may be present, the severity of the shock still remains a matter of clinical impression.

In this series of patients, the blood pressures were low in all, the pulse was weak in all, but in a large number the heart rate was not as fast as one would expect of a patient in shock. One striking observation was the severity of the clinical appearance in some with only moderately depressed blood pressure, while others had very low blood pressures for long periods and still clinically the patients did not appear to be in a critical condition.

The subjective symptoms and the objective findings of shock are so variable that it is often difficult to diagnose true shock. For this reason this report is only concerned with the treatment of the hypotension following trauma of hemorrhage with or without the presence of shock.

The mechanism of shock is still in dispute, but whether it is toxic or reflex, or a combination of both, there is agreement that there is a loss of the effective blood volume. There is a difference of opinion whether the blood merely stagnates in the vascular system (the patient bleeding into his own vascular system) or whether there is a passage of plasma from the vascular system with a decrease of the effective blood volume in this manner. The result of this study would tend to support the first view. The rapid and sustained rise in blood pressure following the subcutaneous injection of the neo-synephrin hydrochloride seems most easily explained by rapid decrease in the volume capacity of the vascular depots of the body and in this way increasing the effective blood volume. There is also the associated increased cardiac output as is demonstrated by experiments which have been previously reported.

It has been recognized throughout this study that no single treatment is adequate in the treatment of shock, and in this series of patients neo-synephrin hydrochloride has been used only as an adjunct to the other recognized forms of therapy. Many of these patients would have recovered without the use of this drug but if used as recommended, it offers a safe and rapid method of sustaining the blood pressure during the critical stage while other recognized forms of treatment for shock are being instituted.

CASE 1 Paul Stoner white male, aged 52 years was admitted to St. Luke's Hospital on June 19 1936. Following is a tabulation of the clinical course.

Date	Time	Blood pressure	Remarks
6-19-36		148/96	Admitted
6-23-36	7 00	110/70	Transurethral resection bled profusely
	9 00	70/40	5 mgm neo-synephrin given subcutaneously
	10 15	90/70	
	11 00		5 mgm neo-synephrin given subcutaneously
	12 30	112/90	
	1 00	116/90	
	2 00	114/88	
	2 30	114/88	
	3 00	110/80	
	4 00	110/80	
	5 30	116/86	
	6 30	116/90	
	7 30	132/90	

CASE 2 Charles Sutherland white male, aged 67 years was admitted to St. Luke's Hospital, on September 2, 1936 for prostatectomy by Dr. Culver. Following is a brief résumé of clinical course.

Date	Time	Blood pressure	Pulse	Remarks
9-4-36		164/112	103	
9-8-36	9 36			Operation started avertin ether anesthesia
	10 15	60/7	80	
	10 25	74/60	74	
	10 35			10 mgm neo-synephrin given subcutaneously
	10 45	110/100	70	
	10 50	140/110		
	11 15	122/92		
	2 30	110/78	88	
	3 30	110/78	86	
	4 10	115/86	84	
	6 00	110/72	92	
	10 2	114/78	88	
	12 00	120/80	116	
9-9-36	10 30	110/80		

Patient went on to recovery

CASE 3 Herman Gorgas, white male, aged 61 years, private patient of Drs Baker and Culver, was admitted to St Luke's Hospital for transurethral resection

Record of the blood pressure follows

Date	Time	Blood pressure	Remarks
5-27-36	1 00	116/96	Admitted
5-29-36			Transurethral resection
	1 45	74/60	Chill
	1 50		5 mgm neo-synephrin given subcutaneously
	2 00	90/64	
	2 10	86/60	
	2 20	80/60	
	2 25		5 mgm neo-synephrin given subcutaneously
	2 30	94/66	
	2 40	96/70	
	2 45	96/68	
	6 00	84/62	
5-30-36		114/74	
6-1-36		120/70	

Patient went on to recovery

CASE 4 Thomas P Dudley, white male, aged 71 years, was admitted to St Luke's Hospital, on September 27, 1936, as a private patient of Dr George Coleman. On October 3, 1936, a left nephrectomy was done by Dr H E Jones. The operation was started at 3 25 and finished at 5 20. At 8 30 ten milligrams of neo-synephrin hydrochloride was given subcutaneously after which the blood pressure continued to rise slowly.

Record of the blood pressure and of the pulse pressure follows

Date	Time	Blood pressure	Pulse	Remarks
10-3-36	3 25			Operation started
	5 20			Operation finished
	5 55	88/68		
	7 45	50/30	130	
	8 10	66/46		
	8 30	66/46	124	10 mgm neo-synephrin given subcutaneously
	8 56	90/56		
	9 55	106/72	108	
10-4-36	5 30	112/64	108	

CASE 5 Charles McNeil, white male, aged 76 years, was admitted to St Luke's Hospital, on September 19, 1936, as a private patient of Dr Culver, for a perineal prostatectomy

Date	Time	Blood pressure	Pulse	Remarks
9-20-36		130/80	76	
9-28-36	9 37			Operation started
	10 15			Operation finished
	10 47	40/??		10 mgm neo-synephrin given subcutaneously
	10 58	90/68		
	11 08	150/80	82	
	11 20	150/80		
	11 46	76/40		
	12 00	70/??		10 mgm neo-synephrin given subcutaneously
	12 14	170/100		
	12 30	174/90		
	12 50	104/50	90	
	1 18	66/56		10 mgm neo-synephrin given subcutaneously
	1 45	130/90	84	
	2 00	80/60		
	3 00	78/60		
	3 30	78/60		
	4 00			5 mgm neo-synephrin given subcutaneously
	4 15	116/60		
	4 30	116/60		
	4 45	86/50		
	5 00	82/58		5 mgm neo-synephrin given subcutaneously
	5 15	96/68		
	5 30	94/60		
	5 45	88/60	100	
	6 00	88/60	100	
	6 15	68/52	92	
	6 30	70/50	92	
	6 45	74/52	94	
	7 10			5 mgm neo-synephrin given subcutaneously
	7 15	94/60	92	
	7 30	94/80	90	
	7 45	90/80	92	
	8 00	96/80	90	
	8 15	90/78	88	
	8 30	78/64	86	5 mgm neo-synephrin given subcutaneously
	8 45	92/78		
	9 00	90/78	88	
	9 15	92/80	88	
	9 30	90/80	90	
	9 45	100/82		
	10 00	96/80	96	
	10 15	90/80	96	
	10 30	86/70	96	
	10 45	80/72	96	

CASE 5—Continued

Date	Time	Blood pressure	Pulse	Remarks
	11 00	76/64	96	5 mgm neo-synephrin given subcutaneously
	11 30	90/80	90	
	12 00	90/82	90	
9-19-	12 15	96/80	88	
	12 30	90/78	88	
	1 0	90/76	88	
	1 45	80/70	90	
	2 00	80/72	88	
	2 30	2/04	90	5 mgm neo-synephrin given subcutaneously
	35	90/70	96	
	3 00	92/80	100	
	3 15	96/82	100	
	3 30	90/80	9	
	4 00	95/80	90	
	4 15	92/78	90	

a m

The blood pressure remained at about 90/60 until 1 00 p m at which time it rose to 112-70 and has maintained itself above this level since. The patient lost a great deal of blood following operation. On admittance the red blood count was 5 040 000 and the hemoglobin 74 per cent and 2 days later it was 2 860 000 with 47 per cent hemoglobin.

CASE 6 J R white male aged 69 years, private patient of Dr Culver and Dr Baher, was admitted to St Luke's Hospital October 5 1936 for a trans urethral resection of the prostate. A carcinoma of the prostate was found. Following is a tabulation of the clinical course.

Date	Time	Blood pressure	Pulse	Respiration	Remarks
10-5-36	11 00	118/76	76	18	
10-6-36	8 00				Operation started
	8 50				Operation finished
	11 30	77?			10 mgm neo-synephrin given subcutaneously
	1 45	96/68	90	20	
	11 55	146/80	90	20	
	12 00	158/100	60	18	
	12 30	60/0			5 mgm neo-synephrin given subcutaneously
	12 35	90/70			
	12 45	126/86			
	12 50	120/84			
	1 00	102/74	88	20	
	1 05	70/58			5 mgm neo-synephrin given subcutaneously

CASE 6—Continued

Date	Time	Blood pressure	Pulse	Respiration	Remarks
	1 15	104/56			
	1 30	100/80	98	18	
	2 00	64/0			5 mgm neo-synephrin given subcutaneously
	2 05	94/64	108	18	
	2 15	94/70	100	18	
	2 30	84/70	108	20	
	2 45	80/65	100	20	
	3 00	74/60	104	20	
	3 05	64/50			5 mgm neo-synephrin given subcutaneously
	3 15	80/64	98	20	
	3 30	90/70	88	18	
	3 45	80/60	90	18	
	4 00	76/58	94	18	
	4 15	70/58	96	18	5 mgm neo-synephrin given subcutaneously
	4 30	90/56	90	18	
	4 45	90/56	80	18	
	5 00	80/56	84	18	
	5 15	80/56	88	18	
	5 45	78/58	94	20	
	6 00	64/40	96	18	5 mgm neo-synephrin given subcutaneously
	6 15	104/68	80	18	
	6 30	100/60	84	18	
	6 45	100/60	84	18	
	7 00	80/54	96	20	
	7 30	54/0		16	5 mgm neo-synephrin given subcutaneously
	7 40	54/46	98	16	
	8 00	78/54	84	20	
	8 15	70/50			5 mgm neo-synephrin given subcutaneously
	8 30	92/68	80	20	
	9 00	78/58	80	20	
	9 15	60/44	80	20	5 mgm neo-synephrin given subcutaneously
	9 35	0/60	88	20	5 mgm neo-synephrin given subcutaneously
	9 55	76/62	84	20	
	10 30	74/52	84	20	
	11 30	56/48	108	22	5 mgm neo-synephrin given subcutaneously
	12 00	68/58	100	20	
10-7-	12 30	52/48	96	20	5 mgm neo-synephrin given subcutaneously
	1 00	78/56	88	20	
	1 30	60/42	96	20	5 mgm neo-synephrin given subcutaneously

CASE 6—Continued

Date	Time	Blood pressure	Pulse	Respiration	Remarks
	2 30	70/50	84	20	
	2 30	53/32	92	20	5 mgm neo-synephrin given subcutaneously
	3 10	72/56	83	20	
	3 30	62/52	85	20	5 mgm neo-synephrin given subcutaneously
	4 00	74/58	92	20	
	4 30	62/52	90	20	5 mgm neo-synephrin given subcutaneously
	5 10	70/56	83	20	
	5 30	72/56	83	20	
	6 00	62/54	94	20	5 mgm neo-synephrin given subcutaneously
	6 30	70/56	83	20	
	7 00	62/54	90	20	5 mgm neo-synephrin given subcutaneously
	7 15	90/60	84	20	
	7 30	70/58	86	20	
	7 45	62/52	96	22	5 mgm neo-synephrin given subcutaneously
	8 00	72/56	90	22	
	8 15	70/48	96	20	
	8 30	64/40	102	20	5 mgm neo-synephrin given subcutaneously
	9 00	80/54	96	20	
	9 15	90/54	84	18	
	9 30	94/54	84	18	
	9 45	86/48	90	18	
	10 00	76/50	94	18	
	10 15	76/48	96	18	
	10 30	70/48	96	18	
	10 45	64/40	102	18	5 mgm neo-synephrin given subcutaneously
	11 00	100/62	80	18	

*a m
tp m

The blood pressure in this patient (Case 6) continued to fluctuate between 80 and 100 and, without neo synephrin, rose spontaneously to 118/60 at 6 45 p m, on October 8, 1935. The patient went on to recovery from the operation.

SUMMARY

The results of the use of neo synephrin hydrochloride as an adjunct in the treatment of 52 patients with hypotension, with or without shock, from trauma or hemorrhage have been presented with favorable results in all except those who were demonstrated to have died of peritonitis or uncontrolled internal hemorrhage. Three patients died with multiple fractures, in whom the exact cause of death could not be determined by necropsy.

The drug also gave favorable results as a prophylactic to the usual fall of blood pressure during spinal anesthesia and also was very effective to restore the blood pressure in patients in whom a vascular depression occurred before operations on the gasserian ganglion.

I am indebted to the Surgical Staff of St Luke's Hospital, Dr Loyal Davis of Passavant Hospital, and Dr G de Takats of the Illinois Research Hospital for the privilege of making this study upon their patients.

REFERENCES

- CHEN K K. Ephedrine and related substances. *Medicine*, 1930, 9, no 1.
- JOHNSON, CARL A. A study of neo synephrin HCl in the treatment of acute shock from trauma or hemorrhage. *Surg Gynec & Obst*, 1936, 63, 35-42.
- KUSCHINSKY G, and OBERDISSE K. Arch f exper Path u Pharmacol 1931, 162, 46.
- SOLLMAN, TORALD. A Manual of Pharmacology. Philadelphia W B Saunders Co 1936.
- TAINTER and STOCKET. Comparative actions of sympathomimetic compounds. *Am J M Sc* 1933, 135, 832.

FRACTURES IN CHILDREN

J DEWEY BISGARD, M D, and LEE MARTENSON, M D, Omaha, Nebraska

TO obtain an adequate appreciation of the clinical importance of the epiphyseal cartilages one has only to reflect that abnormalities of growth are responsible either solely or in part for the majority of deformities of the extremities that arise during the growth period. These cartilages which are productive of all growth in the length of long bones are very responsive to many influences and these influences can be classified broadly into two groups (1) those of a generalized character which act upon all epiphyseal cartilages simultaneously and equally and produce generalized and symmetrical abnormalities of growth such as occur as a result of nutritional and vitamin deficiency states and as a result of abnormal function of certain glands of internal secretion, e g, cretinism and pituitary dwarfism, and (2) those of a localized character which alter the growth activity of only one or at most of only a few of the epiphyseal cartilages and give rise to asymmetrical abnormalities of growth. Excluding growth disturbances resulting from embryonic abnormalities, localized influences are fundamentally (1) vascular, (2) neurogenic, and (3) catabolic.

In a previous publication (1) one of us has shown that prolonged hyperemia of an extremity accelerates growth from the epiphyseal cartilages within the area of hyperemia. Also there is much evidence that the converse is true, that a diminished blood supply retards growth. Again it is probable that growth disturbances which appear to be neurogenic or the result of disuse, as shortening in flail extremities, are fundamentally vascular in origin.

Catabolic influences vary in their effects from temporary insult to partial or complete destruction of the cartilage and are the result of destructive invasion of the cartilage by infection and neoplasms and of injury to it from trauma and from physical agents such as roentgen and radium rays.

For detailed discussions of the many phases of this subject the reader is referred to the many recent publications, among which are those of Phemister, Compere, Harris, Haas, Gatewood and Mullen, Lewin, Snyder, Bisgard (2, 3), Bisgard and Hunt (4), Brooks and Hillstrom, Freeman, and McKenzie.

It is the purpose of this paper to present some clinical and experimental studies relative to the influence of trauma upon the epiphyseal cartilage, particularly the injury associated with fractures involving the cartilage and with traumatic separation of the epiphysis.

FRACTURES IN CHILDREN

In 1935 Compere reported observations in a series of 290 fractures of long bones in chil-

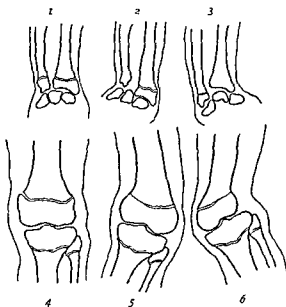


Fig 1 Illustrated in top row are deformities resulting from arrested growth in one of two parallel bones. 1 Normal relations at wrist joint. 2 Growth arrest in distal ulna with resultant ulnar deviation of the hand. 3 Growth arrest in distal radius with radial deviation of the hand. In bottom row are depicted deformities from unilateral growth following growth arrest on one side only. 4 Normal relations of knee joint. 5 Valgus deformity from growth arrest on medial aspect of distal femur and continued growth on lateral aspect. 6 Varus deformity resulting from opposite mechanism.

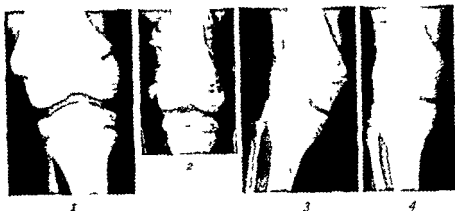


Fig. 2. Fracture with separation of the distal epiphysis of the femur in a boy of 12 years. 1. Before reduction. 2. After reduction which is anatomically perfect. 3. 3 years later. On the lateral aspect the epiphyseal line has become obliterated, the epiphysis fused to the diaphysis and growth on this side arrested. Continued growth on the mesial aspect has produced a knock knee deformity with shortening. 4. The opposite normal knee for comparison. 3 and 4 have been retouched.

dren under 14 years of age. In 12, or 14.4 per cent of his series, the fractures involved the epiphyseal cartilages. Of these, adequate follow-up records were obtainable in 19, and in 18 of these 19 cases, that is in 95 per cent, there had developed definite evidence of disturbances of growth in the traumatized epiphyseal cartilages. Many of these disturbances were so slight that they were detectable only roentgenographically.

A similar investigation was carried out by the authors. During a 5 year period from January 1, 1931, to January 1, 1936, there were admitted to the University of Nebraska hospital 211 children under 16 years of age with 232 fractures of the extremities. The break in continuity involved the epiphyseal cartilage in 49, or 21.1 per cent of the series. Follow-up observations including personal and

roentgenographic examinations were made in 28 of the 49 fractures, all 1 year or more after injury. In only 14, 50 per cent of the 28, was there any roentgenologic evidence of failure of growth to progress normally or of failure of the cartilage to resume normal growth activity. As judged upon a strict anatomical basis 13 of the 28 cases presented residual deformities and in only 8 of these could the deformities be attributed to disturbances of growth. In the 5 other cases the deformities, consisting of limitation of motion and of alteration of the normal carrying angle in diaphyseal fractures of the distal end of the humerus, had resulted either totally or at least in the main from failure to secure exact anatomical reduction of the fractures. In 6 cases (Figs. 2, 5, 6, and 7) shortening had resulted from growth arrest. In 2 of these (Figs. 6 and

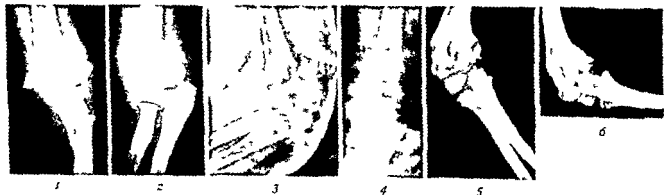


Fig. 3. Diaphyseal fracture with epiphyseal separation of the humerus in a girl of 4 years. 1 and 2. Before and after reduction. Despite an excellent reduction, there developed during the course of 4 years the deformity

shown in 3 and 6. It is apparent that there had been no growth from the mesial aspect and from the mesial epicondyle giving rise to a complete reversal of the carrying angle, an obvious deformity. Function slightly limited.



Fig 4 Fracture evulsion of the external epicondyle and capitulum of the humerus of a boy of 7 years 1 Retouched roentgenogram before reduction. 2 Open reduction and fixation of fragment with pin extending across the epiphyseal line The reduction was anatomically perfect but trauma to the cartilage from the initial injury, from open

operation or from the fixation pin arrested growth at this site and 1 1/4 years later there was a slight deformity from an increase in the carrying angle 3 and 5 4 and 6 Anterior posterior and lateral views of the opposite normal elbow It is in this type of case that a latent ulnar nerve paralysis is likely to develop

7) the epiphyseal cartilage had been destroyed by infection

In 13 cases there were lateral deviations, 6 valgus and 7 varus, and of these 7 could be attributed to growth abnormalities Nine had

some limitation of motion due to deformity to which growth disturbances may have contributed in 4, but if so, to a minor degree only

Fractures are classified in Table I as to distribution and types of deformity

TABLE I—CLASSIFICATION OF CASES WITH FRACTURES INVOLVING THE EPIPHYSEAL CARTILAGES

Epiphyseal cartilages	Cases total	Cases followed	Shortening from		Limited motion from		Valgus and varus deformities from	
			Growth arrest	Other causes	Growth arrest	Other causes	Growth arrest	Other causes
1 Humerus Proximal	1	1	1 (2 in)	0	1	0	0	0
Distal	29	15	1 (1 in)	0	1	5	3	5
2 Radius Proximal	1	1	0	0	0	0	0	0
Distal	0	4	0	0	0	0	1	0
3 Ulna Distal	2		1	0	0	0	1	0
4 Femur Distal	2	2	1 (2 in)	0	0	0	1	0
5 Tibia Distal	4	3	1	0	1	0	1	0
6 Fibula Distal	1	1	1	0	1	0	1	0
Totals	49	28	6	0	4	5	8	5



Fig 5



Fig 6

Fig 5, above. Fracture with separation of the proximal epiphysis of the humerus of a boy of 11 years. 1 and 2 Condition (early malunion) upon admission 3 weeks after injury. 3, After reduction by open operation. Note fixation of fragments by a pin which traverses the epiphyseal line. 4, Four years later total growth arrest from premature fusion as a result of trauma from accident operation and fixation pin. The arm was 2 inches shorter than its fellow. 5, The opposite normal arm. The epiphyseal line is still open (retouched).

Fig 6. Distal humerus fracture of the humerus involving the epiphyseal cartilage in a boy of 8 years. 1. Pre reduction film. 2 and 3. Unsatisfactory reduction and malunion.

Reduction partially lost as a result of removal of fixation dressing to relieve circulatory disturbance and a threatening Volkmann's ischemia. Two months after injury, correction by open operation was done. The wound became infected with sequestration of some of the distal fragment and with destruction of the epiphyseal cartilages and growth arrest occurred. 4 and 5. Condition of the elbow and the deformity 3 years later. There is only 30 degrees of motion with inability to extend beyond a right angle. The forearm deviated mesially and there was shortening of 1 inch.

DEFORMITIES

The deformities which result from disturbances of growth may take a variety of forms as has been pointed out by Phenuster(13). Growth may terminate throughout an entire cartilage equally and simultaneously and in a single bone give rise to shortening only or there may be a cessation of growth in only a portion of the cartilage. As the remainder of the cartilage continues its normal growth activity, the involved end of the bone becomes

twisted by rotation and by deviation from the normal plane, producing rotational, valgus, varus, and other deformities either alone or in addition to shortening. If growth is arrested at one or both ends in only one of two parallel bones such as the radius and ulna or the tibia and fibula, continued normal growth from the other bone deviates the articulating part, the hand or foot, to the opposite side, the side of shortening. These various types of growth disturbances and the deformities that



Fig. 7 Shortening of $2\frac{1}{2}$ inches and valgus deformity of the foot in a boy 14 years old from arrested growth from the distal ends of the tibia and fibula as a result of destruction of the epiphyseal cartilages by infection which complicated compound fractures of the distal ends of both bones 6 years previously at age of 8. The fracture of the tibia involved the epiphyseal cartilage.

they produce are illustrated in Figures 1, 2, 3, 7, 11 and 12. Analyzed upon this basis, the deformities in the authors' series consist of the following:

a. Equal total growth arrest with a shortening only in a single or in parallel bones—1 case, Figure 3.

b. Unequal (fractional or unilateral) arrest with shortening plus valgus or varus deviation—2 cases. Illustrated in Figures 2 and 6.

c. Total arrest in only one of two parallel bones—1 case. (Growth was arrested in the distal end of the ulna resulting in ulnar deviation of the hand.)

d. Unequal arrest in both of parallel bones. Although growth may terminate prematurely in both bones, it may terminate in one earlier than the other or unilateral growth may take place from one or both bones. In addition to shortening there develops lateral deviation. In this group there was 1 case, Figure 7.

e. Unequal or unilateral arrest without demonstrable shortening but with rotation and valgus or varus deformities—3 cases. (All occurred in the distal end of humerus, resulting in loss of the carrying angle in 1 case, an increased angle in 1, Figure 4, and a reversal of the angle in 1, Figure 3.)

INFECTION

Infection involving the fracture site and the cartilage usually results in its destruction and consequent growth arrest. In Compere's series 5 cases were complicated by infection and in all 5 growth was arrested. In the authors' series there were only 2 infected cases. One was an infected compound fracture of both bones of the right leg. The fracture lines in both bones extended into the epiphyseal cartilages which were destroyed by the infection



Fig. 8 Fracture separation of the radial epiphysis of a boy of 13 years also a green stick fracture of distal shaft of ulna. Reduction as shown in the lateral view (fourth from left) was incomplete. Nevertheless growth resumed

and has progressed normally now $2\frac{1}{2}$ years after injury. Note that in the 2 roentgenograms to the right there is no deformity and no abnormality in the appearance of the epiphyseal cartilage of the radius.



Fig 9 Fracture separation of the distal epiphysis of the radius of a boy 11 years old. Although reduction was complete the 2 roentgenograms to the right made $3\frac{1}{4}$ years later show premature fusion of the radial epiphysis as evidenced by obliteration of the epiphyseal line throughout most of its extent. Compare the epiphyseal line in the radius with that of the ulna. Ulnar deviation of the hand was slightly restricted.

and growth was arrested. The resulting deformity is shown in Figure 7. In the other case, a fracture of the distal end of the humerus shown in Figure 6, there was destruction and sequestration not only of the epiphyseal cartilage, but also of part of the epiphysis. Obviously, there was no further growth from this end of the humerus.

Infections are introduced (1) at the time of injury in compound fractures as in Case 1, (2) in the course of an open operative reduction as in the second case, and (3) from extension from infected bone in pathological fractures of osteomyelitis.

SURGICAL TRAUMA

There is much evidence that after fracture each additional insult to the epiphyseal cartilage inflicted directly at open operation or indirectly through manipulation increases the likelihood of growth disturbances. Although complete anatomical reduction is especially desirable, it should not be insisted upon in the presence of a satisfactory reduction, unless it can be obtained without increasing the risk of greater damage to the cartilage. There is no group of fractures in which gentleness of ma-

nipulation and avoidance of open operation are so important. It is not unusual, as shown in Figure 8, for an epiphysis which is only partially replaced to become completely replaced spontaneously or to resume normal growth in spite of incomplete reduction. Compare Figure 8 with Figure 9.

The dangers of open operative reduction are illustrated by cases represented in Figures 4, 5, and 6, and these dangers have been forcefully brought forth by the experimental work of Haas and Gatewood and Mullen. They have shown that in dogs, trauma insignificant as exposure of the cartilage by elevation of the soft tissues may result in premature cessation of growth from that cartilage.

FRACTURE FIXATION

Thus, it follows that reduction by open operation should be accomplished with as little exposure of and injury to the cartilages as possible. Also the reduction should be maintained if possible without the introduction of fixation material and if such material as pins, nails, screws, plates, bone grafts, etc., are used, they should not enter or traverse the epiphyseal cartilage if this can be avoided. If spicules



Fig 10



Fig 11

Fig 10 Fracture separation of the distal tibial epiphysis with green stick fracture of the distal shaft of the fibula in a boy of 13 years before and after reduction. Roentgenograms made 5 years later showed no deformity and gave no evidence that growth had been disturbed. The epiphyseal lines on both the injured and normal sides had fused presumably the physiological termination of growth.

Fig 11 Tuberculosis of the knee joint fused by placing bone grafts across the joint anteriorly. The grafts crossed the epiphyseal lines of both the femur and tibia causing growth arrest anteriorly. As growth progressed posteriorly there developed a recurvatum deformity. Note correction obtained by an osteotomy of the tibia. Continued unequal growth caused a recurrence of the deformity subsequently (Courtesy surgical department University of Michigan)

of bone extend across the epiphyseal line, they should be removed. In short, every effort should be made to maintain an intact epiphyseal cartilage with normal separation between the diaphysis and epiphysis.

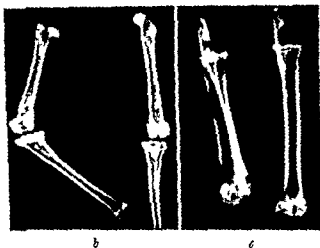
In the 5 cases of the authors' series in which open operative reductions were done, immediate growth arrest followed in 4, and in 3 of these (Figs 4, 5, and 6) fixation pins traversing the epiphyseal cartilages had been used.

It should be emphasized that these were the only cases in the series in which fixation material had been used, thus giving 100 per cent growth arrests.

Phemister(13) has shown that grafts placed across the epiphyseal line so as to establish bony continuity between the epiphysis and diaphysis on two opposing sides stop growth promptly. If only one side is bridged the restriction of growth is confined to that side or



Fig 12 a, Shortening of 10 centimeters in the right foreleg following arrest of growth from the proximal end of the humerus and from the distal ends of the ulna and radius. Growth was arrested by removing much of the epiphyseal cartilage and by bridging the epiphyseal lines on both mesial and lateral aspects by bone grafts as devised by Pheister. These operative procedures were carried out 10 months previously when the animal was 1 month old. b, A bowleg deformity produced by unilateral growth from the distal end of the femur and from the proximal end of the tibia. Growth was arrested on the mesial aspects only and was arrested when the goat was 3 weeks old. As growth continued on the lateral aspects progressive rotation and lateral deviation gradually developed over a period of 11 months. c, Ulnar deviation of the right forefoot which resulted from arrest of growth from the distal end of the ulna when the animal was 6 weeks old. Since growth in the radius continued normally the foot was forced into ulnar deviation.



area and lateral deviation deformities result. This has been emphasized by Snyder and is illustrated in Figure 11, a child with tuberculosis of the knee joint in which grafts were placed across the joint anteriorly for purposes of fusion of the joint. It so happened that the grafts bridged the epiphyseal lines of the femur and tibia restricting growth anteriorly. But as growth continued from the rest of the

cartilage the leg was bent into a recurvatum deformity.

GROWTH ARREST IN EXPERIMENTAL ANIMALS

An investigation of traumatic growth arrest was carried out in 9 of 10 kid goats. One died. All were less than 1 month of age at the beginning of the experiment when they were subjected to operative procedures and all were

observed for evidence of growth disturbances over a period of 10 months or more. Only those epiphyseal cartilages which are known to give rise to a major portion of growth of an extremity were subjected to operative procedures. A brief summary follows.

I In 4 goats the epiphyseal cartilages were exposed at the ends of the bones from which it was planned to arrest growth. With an osteotome a graft 1 centimeter wide and $\frac{1}{2}$ centimeter thick was cut across the epiphyseal line in the manner described by Ilemster. The ends of the graft were transposed so that the longer segment from the diaphysis bridged the epiphyseal line and established bony continuity between the diaphysis and the epiphysis. In only 2 animals was growth arrested: one immediately and one after a lapse of 6 months. In those in which growth failed to become arrested there was roentgenographic evidence of failure of grafts to fuse with the epiphyses.

II After observing only partial success in the first group of animals it was decided to repeat the same studies supplementing the introduction of grafts with removal of some of the adjacent cartilage with a curette. The results were 80 per cent immediately successful and 100 per cent ultimately successful growth arrest being delayed in 1 animal.

1 Bilateral equal or total arrest. In 2 goats grafts were placed on opposite sides across the epiphyseal lines of the proximal end of the humerus and the distal ends of the ulna and radius of the right leg. Much of each cartilage was removed. Growth arrest promptly occurred and 10 months later the right legs were 10 and 12 centimeters shorter respectively than the left ones. A photograph of one animal is shown in Figure 12a.

B Unilateral (unequal or partial) arrest. In 2 goats grafts were placed across the epiphyseal lines at the distal end of the femur and proximal end of the tibia of the left leg. The grafts were placed and the cartilage curetted on the mesial sides of these bones only. In both animals growth ceased on the mesial aspect but continued elsewhere causing some internal rotation of the legs and marked bowlegged deformities. A photograph and roentgenogram of 1 animal appear in Figure 12b.

C Total arrest in only one of two parallel bones. In 2 goats growth was arrested in the distal end of the ulna of the right leg by means of grafts and of removal of cartilage. One animal died. In the other one there developed marked ulnar deviation of the right foot. The deformity is shown in Figure 12c.

TREATMENT

As in treatment of most deformities those arising from disturbances of growth are best treated by application of principles to prevent their occurrence if possible and once developed, to retard their progress. These principles,

as avoidance of damage to cartilage from infection, trauma, etc., have been discussed.

The treatment of established deformities, although following certain general principles, must be planned to meet the problems of an individual case. Most deformities are so slight that no treatment is indicated, some can be relieved or corrected by orthopedic appliances such as braces and shoe elevation while a few demand operative interference.

Shortening of a lower extremity may be treated by operative lengthening of the short leg, operative shortening of the long leg, or by arresting growth from one or more of the epiphyseal cartilages in the long leg. By the latter procedure as devised by Ilemster, growth in the normal or long extremity is retarded in an amount sufficient completely or partially to equalize the length of the two extremities before the normal growth period is terminated.

To correct rotational, valgus, varus, and other deviation deformities corrective osteotomies must be done. However, if unilateral growth is permitted to continue the deformity will gradually recur. Consequently, there are three possible courses to follow: (1) reserve corrective osteotomy until growth has terminated normally, (2) terminate growth completely by operative arrest on the side from which growth is still taking place at the time the osteotomy is done, (3) do repeated osteotomies until growth terminates normally.

So long as the deformity is not too extensive and so long as it does not cause significant remote secondary changes in the extremity and spine from abnormal stresses operative correction may be delayed. If correction becomes necessary in an extremity in which the involved epiphyseal cartilage gives rise to very little growth in length, e.g., the cartilage of the distal end of the humerus or in which the cartilage has reached maturity and will give little or no subsequent growth, total arrest of growth to prevent recurrence of the deformity should be carried out at the time the osteotomy is performed. If total arrest would cause much shortening it would seem wiser to permit unilateral growth to continue and resort to repeated osteotomies thus gaining all length possible. Deformities from arrested growth in one of two parallel bones can be lessened and

occasionally corrected by arresting growth at both ends of the normal or longer bone. Often, however, it is necessary to shorten the longer one or lengthen the shorter one.

CONCLUSIONS

1 Fractures in long bones of children involve the epiphyseal cartilage in more than 10 per cent of cases, 15 per cent in Comper's series, 21 per cent in the authors' series. These latter statistics undoubtedly do not represent accurate cross sections of this group of fractures as a whole because they were collected from clinics which receive disproportionately large numbers of complicated fractures.

2 Deformities of clinical importance developed as a result of growth disturbances in only 6 cases, or 2.5 per cent of our series of fractures in children under 16 years of age. These 6 cases represent only 12 per cent of fractures in which the epiphyseal cartilages were involved in the injury despite the roentgenographic evidence that in 50 per cent of these cases the injured epiphyseal cartilages fused prematurely or failed to resume completely normal growth activity. Obviously in most cases the disturbances of growth which followed injury were insignificant. They gave rise to demonstrable deformities in 8 cases, 2 of them clinically unimportant. These 8 cases represent 28 per cent of the entire group in which the fracture involved the epiphyseal cartilage or 3.5 per cent of the entire series of fractures in children under 16 years of age.

In other words these observations indicate that a child under 16 years of age who sustains a fracture of a principal long bone is confronted with only a 2.5 per cent chance of having an important residual deformity although he has a 20 per cent chance that the fracture will involve epiphyseal cartilage and, if it does, a 50 per cent chance that a growth disturbance usually inconsequential will result.

Since deformities from abnormal growth appear months after a fracture has healed and continue to progress during the remainder of the growth period, every child with a fracture which involves the epiphyseal cartilage should be observed periodically for a year or more and the patient or his family warned of the possibility of this sequela.

Another late complication which deserves mention is the ulnar nerve paralysis which develops as late as 30 years after a fracture involving the epicondyles of the humerus. In these cases the ulnar nerve becomes injured from impingement between the mesial condyle and olecranon as a result of the deviation deformity which results from malunion or from arrested growth from one of the epicondyles, particularly the external one.

3 Certain factors greatly increase the likelihood of growth disturbances and often certain of them are avoidable.

a Infection—growth was arrested in every instance in which infection occurred, 4 cases.

b Trauma—repeated manipulations and rough handling unquestionably increase the incidence of growth irregularities and should be avoided or minimized. Complete anatomical reduction should not be insisted upon in the presence of a satisfactory reduction if its accomplishment increases greatly the risk of damage to the cartilage. Open operation resulted in growth disturbances in 4 out of 5 cases. Fortunately, separated epiphyses usually reduce very easily. Incompletely replaced epiphyses may become completely replaced spontaneously and persistence of incomplete reduction does not necessarily result in a disturbance of growth.

c Fixation—damage to the epiphyseal cartilage from pins, nails, and other foreign material traversing the cartilage when used to fix fragments and to maintain reduction, results often if not invariably in disturbances of growth. Growth was arrested in 100 per cent or all 3 cases in the authors' series, and it is probable that reduction could have been maintained in all of them without use of direct fixation. Undoubtedly, internal fixation is frequently used unnecessarily. Similarly, total, partial, or unilateral growth arrests develop when bone grafts are placed across the epiphyseal line or when fragments extend across it so as to establish bony continuity between the diaphysis and the epiphysis.

4 The types of deformities and their treatment have been discussed. It should be emphasized that the possibility of a growth disturbance should be anticipated at the time of injury and the need of special consideration of

the epiphyseal cartilage in the handling of fracture recognized

BIBLIOGRAPHY

- 1 BISGARD J D Longitudinal growth of long bones. Influence of sympathetic de innervation Ann Surg 1933 197 3,4
- 2 Idem Longitudinal overgrowth of long bones with special reference to fractures Surg Gynec & Obst. 1936 62 823
- 3 BISGARD J D and BISGARD M E Longitudinal growth of long bones Arch Surg 1935 31 568-578
- 4 BISGARD J D and HUNT H B Influence of roentgen rays and radium on epiphyseal growth of long bones Radiology 1936 26 56
- 5 BROOKS B and HILLSTROM H T Effect of roentgen rays on bone growth and bone regeneration Am J Surg 1933 20 599
- 6 COMPERE E L Growth arrest in long bones as result of fractures that include the epiphysis J Am M Ass 1935 105 2140
- 7 FREEMAN R G Skeletal development and growth at ages 2 to 18 months 2 to 7 $\frac{1}{4}$ years and 8 to 14 $\frac{1}{2}$ years Anthropol Anz 1933 10 185
- 8 GATEWOOD and MULLEN B P Experimental observations on the growth of long bones Arch Surg 1927 15 215
- 9 HAAS S L The changes produced in growing bone after injury to the epiphyseal cartilage plate. J Orthop Surg 1919 1 67 166 226
- 10 HARRIS H A Bone Growth in Health and Disease London Oxford University Press, 1933
- 11 LEWIN P Epiphyses their growth development, injuries diseases Am J Dis. Child 1929 37 141
- 12 MCKENZIE B E Deformities and disabilities resulting from injuries or diseases of the epiphyses. Canadian J M & S 1903 14 431
- 13 PREMISTER D B Operative arrestment of longitudinal growth of bones in the treatment of deformities J Bone & Joint Surg 1933 15 1
- 14 Idem Bone growth repair Ann Surg 1935 102 261
- 15 SNYDER C H Deformities resulting from unilateral surgical trauma to the epiphyses Ann Surg 1934, 100 333

CONGENITAL ABNORMALITIES—PHOCOMELUS AND CONGENITAL ABSENCE OF RADIUS

LUTHER L. HILL, JR., B.S., M.D., M.S., Montgomery, Alabama

MUCH interest is always manifested in patients with rare congenital deformities and the discussion of such cases is usually well worth the time devoted to the subject.

A fetus with hands and feet but no arms or legs is known technically as phocomelus. The name is derived from the Greek "phoco" meaning seal and "melus" a limb. The term was probably suggested by the resemblance of the position and size of the hand to the flippers of a seal.

There is no scientific term for congenital absence of the radius. It has been classified, however, as ectromelus which again is derived from the Greek "ectro" implying abortion and "melus" a limb. Phocomelus is also a type of ectromelus.

TERATOGENESIS

It is interesting to review the theories of the probable cause of severe congenital abnormalities. They can be very nicely divided into two groups, the germinal (or hereditary), and the external (or environmental). Many authors champion one theory and exclude all others. This does not seem wise. It is more than likely that both theories are correct. The fact that monsters may develop from one cause does not prevent them from developing from other causes.

Hirst believes all monsters are probably produced by external influences upon normal ova. In summarizing the present knowledge of the probable causation of monsters Hirst says "it is fair to state that faulty implantation of the ovum, probably due to insufficient preparation of uterine mucosa by follicular and luteal hormones, plus mechanical and chemical environmental influences must be held accountable, rather than inherent germ tendencies." He believes double monsters may be imagined as single ovum or identical twins which have not completely separated.

The process of separation is attributed to delay in the implantation and nourishment of the ovum. Hirst referred to the important work of Newman and Patterson with the 9 banded armadillo. In this animal the fertilized ovum lies quiescent in the uterus for 3 weeks prior to the formation of the placental attachment and always results in the birth of 4 monozygotic young of the same sex.

Bagg reports experimental work to justify the environmental theory. He says the type of abnormality developed depends upon the time of application of the disturbing factors. An experimental disturbance during the very early embryonic period produces, very likely, eye defects. An identical disturbance acting somewhat later results in defective brain or bronchial system, and still later, in malformation of the viscera.

Stockard says that the various disturbing agents producing the abnormalities all tend either temporarily to slow or almost completely to stop the development rate.

If the rate of development of an embryo is reduced for a limited period, then that part of the body which at that time normally would be developing the fastest is chiefly affected. Thereafter it is never able to regain its normal rate of development in proper relation to other parts of the organism and hence is defective.

O'Brien and Mustard seem to think that the germinal theory is likely. They report three monsters in one family all phocomelia but one with harelip in addition. The mother and father were double first cousins. Adair also inclines toward the germinal theory. He calls attention to the occurrence of similar deformities in identical twins, such as harelips. He also refers to case reports of mongolian idiots. Both members of fraternal or dizygotic twins are never affected while both members of identical or monozygotic twins are always affected.

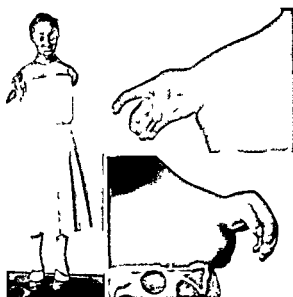


Fig 1 left Notice how the hands inserting directly into the trunk resemble the flippers of a seal

Fig 2 right above A near view of the right hand The thumb is fixed in the palm of the hand in this position

Fig 3 right below A near view of the left hand

Amniotic adhesions are now generally regarded as rarely if ever responsible for monsters. A few years ago, however they were considered very important, and there are still some who attribute certain abnormalities to these amniotic bands.

Attention should be called to the generally recognized ability of radium and therapeutic

doses of roentgen ray to produce various deformities in the fetus.

The incidence of syphilis in a series of malformations reported by Hirst is interesting. In a series of 3,500 consecutive viable births 22 malformations were reported with an incidence of syphilis of 9.5 per cent. Of 22 malformations 7 were sufficiently severe to be classed as monsters and of this group 2 were syphilitic. This gives an incidence of 29 per cent while the incidence of syphilis in the entire series was about 6 per cent.

REPORT OF SIMILAR CASES

Phocomelus is an unusual condition. The *Index Medicus* and the *Quarterly Cumulative Index Medicus* list only 3 case reports from the English and American literature since 1920 (5, 7, 8).

One of the most celebrated cases of phocomelus is described by Gould and Pyle and referred to by O'Brien and Mustard. The monster Marc Cazotte, commonly known as "Pepin," died in Paris about 1800 at the age of 62 from a chronic intestinal disorder. "He had no arms, legs, or scrotum but from very jutting shoulders on each side were well formed hands. His abdomen ended in a flattened buttock with badly formed feet attached. He was exhibited before the public and was celebrated for his dexterity. He performed nearly all the necessary actions and exhibited skillfulness in all of his movements."



Fig 4



Fig 5



Fig 6

Fig 4 Appearance of same patient from behind

Fig 5 Patient buckling left shoe with right hand

Fig 6 The patient is feeding herself with a spoon in right hand



Fig 7 A roentgenogram of the right upper extremity
A detailed description is given in the text



Fig 8 A roentgenogram of the left upper extremity
A detailed description is given in the text

Pepin was quite a clever man, traveling over Europe on horse back, speaking and writing four languages." His skeleton is preserved in the Musee Dupuytren.

Congenital absence of the radius is comparatively much more common. Kato collected 253 cases reported in the literature up to 1923 and gives a masterly review of the subject.

CASE REPORT OF PHOCOMELUS

Minnie Marr is a colored girl 30 years old. She has one brother who is entirely normal and no sisters. There are no obvious deformities of any other member in her family. Minnie's parents are not blood kin. She has the mentality of the average poor ignorant negro girl and has attended 1 year of school.

Minnie uses her hands remarkably well. She dresses and undresses herself even to buckling or tying her shoes. She feeds herself without assistance. She mops or sweeps the floor and is able to carry out most of her household duties unassisted.

Minnie has never been seriously ill. Both Wassermann and Kahn tests are strongly positive.

Physical examination reveals a well nourished muscular negro who is in good health and free of abnormalities except as mentioned below. There is a complete absence of both arms and both forearms. The hands articulate with the trunk on both sides where the head of the humerus should be. The right hand is about a third larger than the left. Minnie is right handed and uses this extremity much more than the left. Both are a little smaller than we would expect in a person of her size (Figs. 1 to 6).

Motion in both hands is very free. The entire hand can be flexed, extended, rotated, abducted, and adducted. The motion of each finger is also free except for the thumbs. Both thumbs are flexed and adducted in the palm, from which they can not be voluntarily moved.

The roentgenograms of Minnie show very strikingly the absent arm and forearm. On the right side

the scapula is small and poorly developed (Fig. 7). The coracoid process cannot be identified. The acromion is elongated, narrow, and articulates at its tip with the poorly developed distal extremity of the clavicle. There is no trace of a glenoid cavity. Immediately distal to the clavicle and scapula and separated from them by soft tissue is a flat but very irregular bone measuring approximately $1\frac{1}{2}$ by $1\frac{3}{8}$ by $\frac{3}{4}$ inches. This bone cannot be definitely identified, by its size or shape. It seems to articulate distally with the carpal bones so that it might be interpreted as the lower end of the radius. The carpal bones are arranged in two rows—a proximal and a distal. All of the proximal bones are fused into one. Faint lines can be seen which represent the point of fusion. The distal row of bones is also fused except for one in the position of the greater multangular. No one bone or segment has the appearance of a normal carpal bone but the articulation between the proximal and the distal row is very definite. The metacarpals and the phalanges are normal.

The roentgenogram of the left upper extremity reveals a very small, almost infantile scapula (Fig. 8). No glenoid fossa is visible but there is a small acromion which apparently articulates with a fairly well developed clavicle. The coracoid process is absent. Distally there is a small flat irregular bone measuring about $1\frac{1}{4}$ by $1\frac{3}{8}$ by $\frac{1}{2}$ inches which seems freely movable and attached to the other bones only by muscles and ligaments. More distally are the poorly developed and poorly differentiated carpal bones. The most proximal one of which is a spherical bone about $\frac{1}{4}$ of an inch in diameter which has none of the characteristics of any of the carpal bones. Immediately distal to this and articulating with it is an elongated bone apparently representing the remainder of the proximal row fused together. Indefinite lines can be seen which represent the lines of fusion of these bones. The distal row is also fused except for a bone in the normal position of the greater multangular, but which does not resemble it. The metacarpals and phalanges are normal. Measurements given for the above bones were taken from roentgenograms.



Fig 9



Fig 10



Fig 11



Fig 12

Fig 9 Congenital absence of the radius

Fig 10 A near view of the palmar surface of the right upper extremity Compare this picture with the roentgenogram (Fig 13)

Fig 11 A near view of the dorsal surface of the right upper extremity Radial club hand

Fig 12 Position of the right arm and forearm while introducing food into the mouth



Fig 13 Roentgenogram of the right forearm and hand



Fig 14 Roentgenogram of the left forearm and hand.

On the right side a short cervical rib is present. The roentgenogram which includes the heart shadow gives the impression of a greatly enlarged heart. The heart is really not enlarged, the appearance is attributed to the technique used in taking the film.

CASE REPORT OF CONGENITAL ABSENCE OF RADIUS

Robert Alred is a white boy 24 years old. He has several brothers and sisters who are all entirely normal. There are no obvious deformities in any other member of his family. His parents are not related by blood.

Robert was born in the vicinity of Clanton, Alabama. His deformity did not prevent him from leading a very active childhood. In high school he served as pitcher on the first string baseball team, as a halfback on the first string football team, and guard on the basketball team. Bob has above the average intelligence. He is friendly and very popular in his community. He is in good health and has never been seriously ill. The Wassermann and Kahn tests are negative. At an early age he had some form of minor operation upon one of his forearms but no difference could be seen in the

deformity or function after the operation. He also had several operations for the correction of severe congenital (knock knee) genu valgum.

Physical examination reveals a white boy well developed and well nourished except as mentioned below. There is a bilateral complete absence of the radius. The wrist is sharply abducted giving the position referred to as radial club hand. Motion of the hand is very free. Motion of the elbow joint is free (Figs 9 to 12).

There is a moderate degree of genu valgum and numerous scars are present on the leg which represent the marks of former operations.

The roentgenogram reveals a complete absence of both radii. The ulnar is curved slightly forward and to the radial side. The carpal bones seem partially fused but this can not be positively made out from the roentgenogram. The metacarpal and phalanges are normal (Figs 13 and 14).

SUMMARY

Severe congenital abnormalities arise from hereditary and very early environmental causes. The environmental causes probably act by temporarily slowing the growth of the

fetus The part or organ normally developing most rapidly during this time gets behind and never catches up as the rate of growth returns to normal

Cases of phocomelus and congenital absence of the radius reported in the literature are reviewed One case each of phocomelus and congenital absence of the radius are reported by the author

BIBLIOGRAPHY

- 1 ADAIR, F L Fetal malformations in multiple pregnancy *Am J Obst & Gynec*, 1930, 20 539-552
- 2 BAGG, H J Etiology of certain congenital defects *Am J Obst & Gynec*, 1924, 8 131-141
- 3 GOULD, G M, and PYLLE, W L *Anomalies and Curiosities of Medicine*, p 263 Philadelphia W B Saunders Co, 1897
- 4 HIRST, J C *Monsters Cyclopedia of Medicine*, vol 8 p 972 Philadelphia F A Davis Co, 1934
- 5 HOLT, C Case of phocomelus *Lancet*, 1920, 2 128
- 6 KATO, KATSUJI Congenital absence of the radius *J Bone & Joint Surg*, 1924, 6 589-616
- 7 MCCONNEL, G Congenital absence of both forearms simulating phocomelus *Internat A M Museums Bull*, 1922, pp 156-159
- 8 O'BRIEN, H R, and MUSTARD, H S An adult living case of total phocomelia *J Am M Ass*, 1921, 77 1964
- 9 STOCKARD, C R Developmental rate and structural expression *Am J Anat*, 1921, 28 115

THE ENDOCRINE BACKGROUND OF THE TOXEMIAS OF LATE PREGNANCY

EVAN SHUTE B.A. M.B., F.R.C.S.C., London Ontario, Canada

NO disease nor group of diseases has better merited the term "disease of theories" than the toxemias of late pregnancy. Every textbook on obstetrics presents long lists of factors to which these toxemias have been ascribed. Moreover, there has been wide disagreement on methods of therapy. We seem to have been brought but little nearer the solution of the problem by the extensive investigation of the biochemical processes involved. Inevitably this very fact must lead any thoughtful student of the subject to wonder if some new approach is not indicated—an attack on the problem made from a totally different point of view. Flushed with its recent triumphs in the study of the physiology and pathology of sexual phenomena, endocrinology may be pardoned therefore for intruding into this field. A study conducted on a small group of cases such as is accessible to us can, of course, never be conclusive, but it may suggest something which larger centers can carry to a fortunate and decisive result.

THE TWO TYPES OF SEVERE LATE TOXEMIAS

If we remove from our minds, for the moment, all that has been learned so laboriously about the classification of these late toxemias and their interrelationships, we can see that two clinical types stand out pre-eminently. One is the group of cases ending in eclampsia if sufficiently severe. The other is the group ending in abruptio placentae, if sufficiently severe. All the milder forms of these types we have long lumped together simply as "toxemias" or "pre eclampsia" because we have had no sure and simple method of differentiating between them before they showed themselves full face. For the moment let us

begin the question of the "low reserve kidney," "essential hypertension in pregnancy" and other such problems. The matter of renal vascular disease will be mentioned later.

A little thought will suggest that it may be quite erroneous and misleading to use such a crude classification as "pre-eclampsia" for cases which seldom go on to true eclampsia whether managed skillfully or otherwise. Most practitioners see many such cases of pre-eclampsia, but only very, very few true eclamptics. If pre-eclampsia be so common why should eclampsia be so uncommon? We can scarcely flatter ourselves that we ward off the convulsive stage of these toxemias by our various and feeble therapeutic measures. When we are brought face to face with a true full-blown eclampsia, it is impressed on us very forcibly how ineffectual are our present methods to ward off further convulsions. Is it possible that only a very few of these mild, non-convulsive, "late toxemia" patients are really pre-eclamptics? Perhaps pre-eclampsia is almost as rare as eclampsia?

With this re-orientation of viewpoint as a beginning, let us turn to the full-blown cases of eclampsia and abruptio placentae, to see if recent researches distinguish fundamentally between them. The Smiths demonstrated that both the blood and placentae of eclamptic women were characterized by a low estrin content and an excess of the antagonistic placental or pregnancy urine gonadotropic hormone. Heim found in both eclamptics and abruptio cases a very high prolactin as well as estrin excretion. Bickenbach and Fromme observed no increase in the blood content of estrin in 4 cases of eclampsia. Nicholson, since 1901, has noticed that the more normal was the thyroid gland the less likely was toxemia to develop. He stated that a woman was safe from toxemia if she were a hyperthyroid rather than a hypothyroid. This conclusion seems very doubtful, however. Hoff

From the Department of Obstetrics and Gynecology, University of Western Ontario. Read at The Hamilton Academy of Medicine, September 9, 1936 and at the Canadian Physiological Society, Kingston, October 30, 1936.

mann and Anselmino have evolved a test for the presence of thyroid secretion in the blood. They found that in eclampsics the amount of this hormone was enormously increased but in pregnancy nephropathy it was much below normal. The significance of these observations on the thyroid becomes greater when the animal experimentation of Weichert and Boyd and of Van Horn is recalled. These workers showed that the administration of thyroid extract to animals increased the excretion of estrin. Moreover, Benazzi produced thyroid hypoplasia in rabbits by means of estrin injections.

Such observations indicate the intimate relationship of hypothyroid states to the accumulation of excess of estrin in the body, and something of the significance of such estrin excess. In 31 pregnant women studied by us, all of them patients in whom the estrogenic substance in the blood serum was at a level so high that it was difficult to control by means of wheat germ oil, fully 22 showed evidence of hypothyroidism.

Of late, the continental literature in particular has been marked by many references to cholin and its derivatives. These appear to be fundamentally related to the activity of the parasympathetic nervous system and the contractility of such smooth muscle as that of the uterus and gut. The values for blood cholin in the two major types of late toxemia indicate an important difference between them. Spath found that 4 women with pregnancy nephropathy displayed a slight increase of blood cholin, but 9 cases of pre-eclampsia showed a marked decrease and 8 of 9 cases of eclampsia gave unusually low values. He observed other evidence to confirm his impression that labor in the true eclamptic is preceded by an actual cholin deficit. Lufinger and Sprado were able to confirm this observation indirectly. They discovered in the blood in pregnancy and some other conditions an inhibitor to the action of yeast on certain monosaccharides. The values for this inhibitive agent were high when the cholin values were low, and proved to be high in eclampsia cases.

The foregoing will indicate that there is a very real basis for distinguishing between the two main types of late toxemia of pregnancy. To

recapitulate, the abruptio toxemias exhibit a high blood estrin, the eclamptic a high prolactin excretion. The former are characterized by a low blood content of thyroid hormone, the latter by a high content. The abruptio case has an elevated blood cholin, the eclamptic a very low cholin value. Years ago Holmes and Williams, as well as other clinicians of note, foreshadowed just such a fundamental division of the late toxemias on purely clinical grounds. Many writers have more recently indicated the rarity of association of abruptio and eclampsia, e.g. Baird, Le Lorier, Davis and McGee, and most recently De Snoo.

Our own observations are of some interest in this connection. In our locality relatively few cases of true eclampsia are seen, but in the past 3 years 8 convulsive cases have been studied completely or in part by the author. Only 1 of the 8 displayed any excess of estrogenic substances in the blood and, in the 1 case in which such a test was made, the prolactin output in the urine was found to be very high. On the other hand, during the same period of time we have been able to study the blood sera of 39 cases of abruptio placentæ of the severe type. Eighty-five per cent of these displayed an excess of estrogenic substance in their blood sera.

THE MILD LATE TOXEMIAS

Can the mild or incipient stages of toxemia of late pregnancy be similarly divided into the same two major categories? We believe it is readily possible, both by means of the laboratory analysis of their blood sera for the presence or absence of an excess of estrogenic substance (21) and by clinical means. This has been discussed at some length in previous publications (23, 24), but is here recapitulated briefly. The cases which show a tendency to premature placental separation and might be called pre-abruptio or mild examples of what the French have so aptly called *hematome retroplacentaire* usually show the following:

- 1 Tenderness—localized, recurrent, and truly uterine. It is first noted at the placental site or at the region of the origins of the round ligaments.
- 2 Backache—sacral region.
- 3 Hemorrhage—fresh, bright red, uterine, not due to placenta previa. Too many physi-

cians seem to think hemorrhage is essential before the diagnosis can be made. Many patients never display external hemorrhage.

4 Small fetus—strikingly small for the duration of gestation. It should be pointed out that Zagami and Sindoni found that the products of conception in E defective rats were unusually small.

5 Weight—maternal weight increasing rapidly.

6 Malaise—"indescribable" and marked.

7 Albuminuria—slight or marked.

8 Blood pressure—some elevation above the normal limit of the individual in question.

9 Bleeding and coagulation time—increased. A similar increase of bleeding time was observed in cases of deficiency of the fat soluble vitamins A and D, by Kugelmass and Samuel, together with a great decrease of blood fibrinogen such as Dieckmann (8) found in cases of abruptio placentæ. It is of great interest that the anti hemorrhagic vitamin K, recently discovered is also a fat-soluble vitamin.

10 Excess of estrogenic substance in the blood serum—for as long as 5 months beforehand.

In regard to hemorrhage, De Lee stressed a very important point, viz, that a fatal intra uterine hemorrhage may occur without a trace of external bleeding. He also stressed the tender uterus and said he had "rarely missed it."

On the other hand, the true "pre eclamptic" reveals

1 Albuminuria—often sudden and marked.

2 Blood pressure—rising rapidly.

3 Small fetus—as above.

4 Visual disturbances.

5 Nausea and vomiting.

6 Headaches—often occipital and usually noticed promptly on awakening in the morning.

7 Weight increase—and edema, or weight increase alone.

8 Rarely an estrogenic excess in the blood serum.

9 High urinary output of prolan—the authorities say it may be enormous.

We have studied during the past 3 years 66 cases of the mild type of late toxemia which

we believe were small retroplacental hematomas and 3 cases of true pre eclampsia. Lightly two per cent of the former revealed the excess of blood estrogenic substance mentioned but the patients with pre eclampsia did not.

It will be observed that cases of mild or severe retroplacental hematoma are not uncommon and outnumber cases of the eclampsia type in our unselected group of cases of late toxemia by 105 to 11. De Lee points out that small retroplacental and intraplacental hemorrhages occur frequently in late pregnancy and organize without producing alarming symptoms. They are demonstrable only on careful inspection of the placenta after delivery. It will be noticed that the subject of abruptio placentæ has been dealt with throughout with no more than a passing mention of nephritis. That has been intentional. It is obvious that the implications of these studies are of great interest in respect to nephritis, hypertension, and renovascular disease as a whole, but as yet we do not feel qualified to make any observations upon those themes.

THErapy

Experience has led us to believe that in pathological states characterized by an excess of estrogenic substance in the blood, such as spontaneous abortion and miscarriage, the administration of wheat germ oil has therapeutic value (22). If these conclusions are correct, therefore, namely, that much the commoner of the late toxemias, the type which may go on to abruptio placentæ, is usually characterized by this excess of estrogenic substance in the blood, then wheat germ oil therapy should be helpful. De Lee succinctly remarks that abruptio placentæ is really an abortion at or near term, and those who have tried wheat germ oil in treating abortion are convinced by this time of its efficacy. On the other hand, a preparation of vitamin E should have little or nothing to offer in the treatment of the much rarer cases of true pre eclampsia or eclampsia. Such proves to be the fact, and one need try this therapy but a few times to be convinced of it.

The wheat germ oil used must be potent, kept cold from the time of manufacture, and should not be more than 8 weeks old. Enough

of it must be administered to "saturate" the patient with vitamin E (22) and maintain that saturation. The true pre-abruptio type of toxemia or any abruptio case not hopelessly out of hand will respond promptly. Inside of 24 hours the blood pressure of such a patient returns to normal or falls markedly. This is true of both the systolic and diastolic pressures, unless the hypertension is of months' standing and the kidneys already show signs of marked damage. The albuminuria decreases or disappears, the weight gain often reverts to a normal rate, the uterine tenderness, sacral backache and hemorrhage promptly cease, the feeling of indescribable discomfort and malaise vanishes. A few women have a sudden and excessive polyuria on taking the oil and lose their edema rapidly. Moreover in a few weeks there sometimes appears to be an unusual increase in size of the fetus. Such an observation was also made by Maxwell in cases of deficiency of vitamin B in pregnancy upon treatment with the indicated vitamin. The response to wheat germ oil therapy is very dramatic.

In more marked cases of toxemia of the same type, wheat germ oil therapy has less to offer. For example, when the hypertension is well established it is little altered by this treatment. But if the patient is saturated with the oil, small hemorrhages cease. (We hasten to add that we have not yet tried our type of treatment on a profusely bleeding patient.) The placenta appears to adhere sufficiently well to render safe the induction of labor and the delivery of the child. These conclusions about the results of this therapy in the severest cases of abruptio placentae are, we reiterate, now merely tentative.

The effect of the oil therapy on cases of retroplacental hematoma is so dramatic and this type of case so common that there is no need to cite case reports to illustrate what occurs. One will be convinced most readily by actually treating such a case in the manner suggested. Certainly we have seen no mild case of retroplacental hematoma recognized early and treated adequately with potent wheat germ oil go on to the classical, severe type of premature placental separation with gross shock and hemorrhage.

One of the most important results of this study has been to differentiate acute appendicitis in pregnancy from abruptio. It is not unusual to see a patient during middle or late pregnancy develop a sudden, severe, right lower quadrant pain with so many signs and symptoms suggesting acute appendicitis that operation seems to be urgently demanded. De Lee recalls three such confusing cases. However, a careful examination to determine if the abdominal tenderness is actually in the uterine wall or to the right of the uterus may make it clear that the placental site is really producing the symptom complex. When in doubt, and some delay is not contra-indicated, the therapeutic test of administering a massive dose of 8 to 12 drams of wheat germ oil is conclusive. On four occasions we have seen such cases, and twice were able to avert useless and even dangerous surgical intervention. The palliative effect of a massive dose of wheat germ oil is so striking that even an impatient surgeon can be promptly convinced.

What has this study to offer in the way of treatment for the true pre-eclamptic and eclamptic type of late toxemia? Our clinical material is too limited to permit a suitable answer to that question. However, we have recently treated 3 such cases with estrin with good results (25). That suggests that therapy based on the antagonism of estrin to the prolactin which is excreted by eclamptics in such large amounts offers some promise.

SUMMARY

- 1 The late toxemias of pregnancy may be grouped, from an endocrinological point of view, into two principal categories, viz those which are eclampsia, real or impending, and those which are retroplacental hematomas or abruptio placentae, real or impending.

- 2 These groups may be differentiated by the fact that the former excrete a great excess of prolactin and the latter are marked by an excess of estrogenic substance in the blood.

- 3 Similarly, studies of thyroid activity and of blood cholin values give further reason for such a fundamental division of the late toxemias.

- 4 The abruptio type exceeds the eclamptic type by about nine to one in our small series.

5 We have found that wheat germ oil is a prophylactic and therapeutic agent of great value in treating the abruptio group

6 There is some reason to suspect that estrin therapy may assist in the therapy of the eclamptic type

Since this paper was prepared and presented a number of reports have appeared which lend some support to the conception it advances of the division of the late toxemias of pregnancy into two groups only one of which is true pre-eclampsia and eclampsia Pastore has reported studies of blood-cell volume Dieckmann (9) general blood studies and Boyd studies of the phospholipid-cholesterol ratio in the blood which tend to this same general conclusion Boyd indeed found much as we did that only 10 per cent of these late toxemias were really pre-eclampsia Dieckmann and Michel (10) found a notable difference in the reaction to pituitary extract of true pre-eclamptics and those pregnant patients with vascular renal disease Robson found that when 12 severely toxic pregnant women were treated with progesterone 1 of the 12 reacted very differently from the rest and was not benefited at all When all the similarities between wheat germ oil and progesterone are considered this fact becomes significant

BIBLIOGRAPHY

- 1 BAIRD D *Lancet* 1936 1 293
- 2 BENAZZI M *Monitore endocrinol* Nov-Dec 1933 1 145
- 3 BICKENBACH W and FROMME H *Klin Wchnschr* 1935 1 496
- 4 BOYD E M *Am J Obst.* 1936 32 937
- 5 DAVIS M E and McGEE W B *Surg Gynec & Obst.* 1931 53 768
- 6 DE LEE J B Personal communication
- 7 DE SNOO K *Monatschr f Geburtsh u Gynaek* 1936 102 257
- 8 DIECKMANN W J *Am J Obst.* 1936 31 734
- 9 Idem. *Am J Obst.* 1936 32 927
- 10 DIECKMANN W J and MICHEL, H L. *Am J Obst.* 1937 33 131
- 11 EUFFINGER, H and SPRADO *Monatschr f Geburtsh u Gynaek* 1935 101 5
- 12 HELM K *Klin Wchnschr* 1934 13 1614
- 13 HOFFMANN F and ANSELMINO K *J Klin Wchnschr* 1931 10 1447
- 14 HOLMES, R W *Am J Obst.* 1923 6 517
- 15 KUGELMASS I N, and SAMUEL, E L. *Am J Dis. Child* 1912 43 50
- 16 LE LORIER, V *Bull Soc d obst. et de gynéc* 1933 24 378
- 17 MAXWELL, J P *J Obst & Gynec Brit Emp* 1932 39 764
- 18 NICHOLSON H O *Tr Fdnb Obst. Soc.* 1935 36 1
- 19 PASTORE J B *Am J Obst.* 1936 32 839
- 20 ROBSON J M and PATERSON S J *Brit M J* 1937 1 311
- 21 SHUTE, E V *J Obst. & Gynec. Brit Emp* 1935 42 1071
- 22 Ibid 1936 43 74
- 23 Ibid. 1937, 44 121
- 24 Idem *Am J Obst.* 1937 33 429
- 25 Idem *Endocrinology* in press
- 26 SMITH G V S and SMITH O W *Surg, Gynec. & Obst.* 1935 61 175
- 27 SPATH B *Monatschr f Geburtsh u Gynaek* 1936 102 167
- 28 VAN HORN W M *Endocrinology* 1933 17 132
- 29 WEICHERT C K and BOYD R W *Anat. Rec* 1933 58 55
- 30 WILLIAMS J W *Obstetrics* 6th ed pp 991 993 New York and London Appleton & Company 1930
- 31 ZACANT V and SRYDONT, M *Riv di pat sper* 1934 N S 1 2

HEMORRHAGE INTO THE PLEURAL CAVITY

JEROME R. HEAD, A M., M D., Chicago, Illinois

THE surgical problem of penetrating wounds of the thorax and hemorrhage into the pleural cavity is as old as warfare between men. From generation to generation, since the earliest times, it has presented itself to the surgeon and has always been and still is a common injury. Hippocrates believed that blood in the pleural cavity always putrefied and formed pus. In the thirteenth century, Guy de Chauliac stated that some contemporary surgeons practiced primary closure of a thoracic wound, while others believed that it should always be left open and eventually dilated and drained. He closed the wound immediately and governed his subsequent treatment by the indications presenting in the particular case. If the course was favorable, he was content, but if dyspnea or sepsis followed he opened the wound and evacuated the blood and pus, packed it between evacuations, and eventually inserted a drainage tube. This practical method, modeled on the Hippocratic treatment of empyema, permitted many to recover without complications and, when complications did develop, met them, but avoided the serious one of an early open pneumothorax. Ambrose Paré followed the same practice. Laennec stated that the wound should be closed so that the pressure of the accumulating blood in the pleural cavity would control the hemorrhage. Trousseau advised strongly against aspiration, and for the same reason.

The development of aseptic surgery and of surgery of the thorax eventually made immediate operative interference a feasible procedure and during the great war early wide thoracotomy with direct control of bleeding and evacuation of blood was frequently practiced. One of the most important wartime developments was made by Morelli of the Italian army who used early pressure pneumothorax to control the bleeding and to permit healing of the wounds in the lungs. In 1933, Connors and Steinbruch reported excellent

results in a large series of patients submitted to immediate operation. Their procedure was to make an incision into the pleural cavity through the wound of entrance, to ligate the intercostal artery proximal and distal to the wound, and to suture the wound in the lung to the chest wall.

My reason for writing on the subject is not to report a large series of cases, but rather to discuss the complicated physiology of hemorrhage into the pleural cavity and to report certain original observations on its effects upon the blood pressure, effects which can be detected clinically and which are important in determining the indications for treatment.

I shall start by reporting a case which illustrates many of the important points.

Miss E. C. was seen in consultation with Dr. O'Neill at the Evanston Hospital on August 4, 1931. Five days previously in an automobile accident, she had suffered a severe injury to the right side of the thorax. A roentgenogram showed that five ribs on the right side were broken and that the right pleural cavity was filled with fluid and air. For the first few days the temperature was elevated to from 100 to 101 degrees F. It then fell to 98 degrees F., and at the same time the pulse rate rose from 110 to 120. When I first saw the patient she presented a picture characteristic of traumatic shock. There was marked pallor, the extremities were cold and the body was covered with beads of perspiration. The pulse rate was 120, and the respiratory rate 26. Breathing was shallow and grunting. The pulse, which was extremely small, disappeared almost completely on inspiration.

The blood pressure on expiration was 102 systolic and 72 diastolic. During inspiration no reading could be obtained at any level. The pressure in the pleural cavity was plus 28 centimeters of water. After 525 cubic centimeters of pure blood had been removed, the pressure in the pleural cavity was lowered to 12 centimeters, and a definite and dramatic change was produced in the patient's condition. The pallor disappeared, the extremities became warm, and the sweating stopped abruptly. The pulse increased in volume, and the rate fell to 100. The expiratory blood pressure rose to 112 systolic and 72 diastolic. The inspiratory pressure was now 90. By the next day the original symptoms and signs had returned. The expiratory blood pressure was 84 systolic and 60 diastolic. There was no inspiratory pressure. The pressure in the pleural cavity was

From the Department of Surgery, Northwestern University Medical School, and the Edwa. Sanatorium, Naperville, Illinois.

plus 12 centimeters of water. After the removal of 900 cubic centimeters of blood, air was injected into the pleural cavity until the pressure was plus 8. The picture was again reversed the blood pressure was then 112 systolic and 65 diastolic.

In this case of traumatic hemopneumothorax the patient was in a chronic state of circulatory collapse (low blood pressure) 5 days after the injury. While the expiratory blood pressure was practically normal, the inspiratory pressure was too low to be recorded and it was obvious that the mean pressure was below the shock level. The immediate response to aspiration of blood indicates that the high intrapleural pressure and the discrepancy between the inspiratory and expiratory blood pressures were important factors in producing the clinical picture.

This exaggeration of the normal respiratory waves in the blood pressure is a constant effect of high intrapleural pressure. I have observed it in pleurisy with excessive effusion and in spontaneous and artificial pneumothorax. It occurs also in acute pulmonary edema and perhaps in some other conditions.

When blood escapes into the pleural cavity, normal cardiorespiratory physiology is attacked from two angles. The progressive decrease in blood volume is complicated and aggravated by collapse of the lungs and by pressure upon the heart and great veins. Either of those conditions may cause death. Combined they supplement each other.

The hemorrhage produces (1) a progressive decrease in blood volume, (2) a progressive decrease in cardiac output, (3) a progressive fall in blood pressure, (4) shock and eventual death from lack of oxygen supply to the vital nerve centers.

Pressure in the pleural cavity produces (1) a progressive collapse of the lungs and decrease in vital capacity, (2) an increased resistance in the pulmonary circulation, (3) pressure upon the heart and great veins, (4) interference with the return of blood to the heart, (5) a rise in venous pressure, (6) a decrease in cardiac output, (7) a marked exaggeration of the respiratory variation in blood pressure, (8) eventual death from a practically simultaneous respiratory and circulatory failure.

The two conditions supplement each other as follows:

- 1 Collapse of the lungs decreases the oxygen saturation of the blood, the volume of which has been decreased by hemorrhage, and so contributes to the failure of oxygenation of the vital centers.

- 2 Pressure in the pleural cavity obstructs the return of venous blood to the heart. This hindrance is more effective and serious if the venous pressure is already lowered by a decrease in blood volume.

- 3 Both the obstruction to venous return and the decreased blood volume diminish the cardiac output.

- 4 The exaggeration of the respiratory waves of blood pressure tends eventually to lower the mean blood pressure and so to augment the similar effect of decreased blood volume.

From these considerations it is obvious that an individual can tolerate a higher intrapleural pressure if his blood volume has not been decreased by hemorrhage, and that he can stand a greater decrease in blood volume if his respiratory and circulatory systems are not compromised by a high pressure in the pleural cavity.

The escape of blood into the pleural cavity is practically always associated with the simultaneous escape of air so that one is confronted with a hemopneumothorax rather than a simple hemothorax. This is of great clinical importance because the relative amounts of blood and air determine which picture will predominate, that of hemorrhage or that of intrapleural pressure, and which condition must be treated. A valvular pneumothorax without hemorrhage may produce death in less than an hour from simple intrapleural compression. Since the pressure in the systemic arteries (120 mm. of mercury) is much above what can be tolerated in the pleural cavity (30 cm. of water) a relatively small hemorrhage into a large pneumothorax will cause death chiefly by raising the intrapleural pressure. On the other hand, if there is no pneumothorax or only a small one, hemorrhage into the pleural cavity will cause death from a decrease in blood volume before the factor of intrapleural pressure becomes in

trinsically important. In every case, however, both factors are important.

Before speaking of the treatment it seems best to consider the clinical aspects of the two conditions, as seen separately and combined, and to point out the symptoms and signs by which one can tell which is the most important and toward which, accordingly, the treatment must be directed. The clinical picture of acute hemorrhage is too well known to require description. Pallor, thirst, restlessness, and sweating, and a rising pulse and falling blood pressure are its outstanding features. Dyspnea and air hunger are late—almost terminal phenomena—occurring only when the blood pressure has become extremely low.

Rapidly rising pressure in the pleural cavity produces symptoms which are chiefly respiratory. Dyspnea appears early and cyanosis is the result of incomplete oxygenation of the blood and of the increase in venous pressure. The type of breathing is characteristic. As the pressure rises, the thorax becomes dilated until the limit of expansion has been reached. Because it cannot be enlarged further by inspiratory efforts, expiration becomes active, the patient forcing the air out by a grunting expiration. Air is drawn in by a passive rebound into the dilated position. Sauerbruch and Nissen have called attention to the fact that immediately following thoracic trauma vagal stimulation may cause a slow full pulse which masks the seriousness of the injury. This is a transient effect and, if pressure develops, gives way rapidly to a rise in pulse rate. The blood pressure remains at a safe level but exhibits an increasing discrepancy between the inspiratory and expiratory levels.

When acute hemorrhage is complicated by a rising intrapleural pressure, a falling blood pressure indicates a predominance of the former, while rapid labored grunting respiration, cyanosis, and an exaggeration of the respiratory waves of the blood pressure indicate that the intrapleural tension is dangerously increased.

THE TREATMENT

Because either the blood loss or the intrathoracic compression or a combination of the two can cause death in a short time, a patient

suffering from acute hemopneumothorax demands extremely close observation until his condition has become stationary at a safe level. Until that time one must watch the indications and be ready to increase the blood volume or decrease the intrapleural pressure or, if these fail, to perform an emergency operation.

The falling blood pressure and the rising intrapleural pressure must be relied upon to stop the hemorrhage, and consequently should be altered only when they become dangerous. If the patient is seen early, artificial pneumothorax may be used in an attempt to stop the bleeding. In general, one can say that a blood pressure falling below 80 millimeters of mercury is an indication for transfusion, while severe dyspnea with markedly exaggerated Traube-Hering waves calls for aspiration of blood or air from the pleural cavity. One must remember that an unduly low inspiratory pressure may drop the mean blood pressure below the critical level, while the expiratory pressure remains well over 100. He must also remember that both phases of the picture may be improved either by increasing the blood pressure or by lowering that in the pleural cavity. Either will both raise the blood pressure and alleviate the symptoms of compression.

One of the striking and unexplained aspects of the condition is that blood in the pleural cavity does not clot—either *in situ* or after it has been aspirated. Theoretically, one should be able to use the patient's own blood for transfusion and by repeated aspiration and reinjection maintain both the pressure in the arteries and in the pleural cavity at safe levels for an indefinite period. In the first few hours, before infection has had time to develop, this procedure is sufficiently sound theoretically to warrant trial.

Once the stability of the blood pressure and respiration indicate that bleeding has stopped, nothing further should be done for 48 hours. Too early relief of pressure may reopen the wound in the lung or cause a recurrence of bleeding. At the end of 48 hours, blood may be aspirated and replaced by air, and this procedure repeated on successive days until the hemopneumothorax is converted into a

simple pneumothorax. This should be maintained for at least 2 weeks to permit the wound in the lung to heal.

Blood in the pleural cavity will usually absorb spontaneously but occasionally will produce a calcification of the pleura which prevents re-expansion of the lung and predisposes to late complications.

Infection of the pleural cavity is surprisingly rare. If persistent and rising fever and positive cultures of aspirated material indicate that it has occurred, drainage must be established. Because in most cases there are no adhesions and the lung is completely collapsed and the mediastinum mobile, the closed method is imperative.

SUMMARY AND CONCLUSIONS

1 When bleeding takes place into the pleural cavity the cardiorespiratory mechanism is attacked from two angles.

2 The effects of decreased blood volume are supplemented by those of high intrapleural pressure.

3 Both of these act to decrease the cardiac output and to compromise tissue respiration.

4 One of the constant effects of high intrapleural pressure is an exaggeration of the respiratory waves of the blood pressure.

5 If the blood pressure is lowered by hemorrhage the further fall during inspiration may lower the mean pressure below the critical level.

6 Because the two conditions supplement each other, the patient's symptoms, both respiratory and circulatory, may be relieved by either increasing the blood volume or decreasing the intrapleural pressure.

7 The predominance of circulatory or respiratory symptoms depends upon the relative amounts of blood and air in the pleural cavity.

8 Because the falling blood pressure and the rising pressure in the pleural cavity act to stop the hemorrhage, treatment should be expectant until either circulatory or respiratory signs and symptoms indicate danger.

9 Blood transfusion or aspiration of air or blood from the pleural cavity should then be applied as indicated.

10 Because blood in the pleural cavity does not clot and rarely becomes infected, aspiration and infusion of the escaped blood is suggested as a reasonable form of treatment.

NOTE.—During the past month I have had occasion to transfuse 1000 c.cm. of blood directly from the pleural cavity into the vein. This was done in a case of postoperative hemorrhage following intrapleural pneumolysis. No anticoagulants were used and no untoward complications developed.

SUBTOTAL GASTRIC RESECTION FOR PEPTIC ULCER

GAVIN MILLER, M D, M Sc, F R C S (C), Montreal, Quebec, Canada

WHILE an increasing number of surgeons are advocating subtotal gastric resection as a routine procedure for cases of peptic ulcer, many are still satisfied with the results of the palliative operations such as gastro enterostomy, especially for duodenal ulcer. Nevertheless all gastric surgeons use resection for certain types of ulcer such as pyloric ulcer with a suggestion of cancerous change, and for marginal ulcer. When any such technically difficult surgical procedure becomes more widely used, the average results become less satisfactory. This is natural as more surgeons attempt a procedure with every detail of which they are not familiar, and may even not have grasped the fundamental principles on which the operation was designed. There are two very important factors in gastric surgery, first, the ability to relieve the patient of all symptoms permanently, second, the mortality following such operations.

The purpose of this paper is not so much to add to the controversy regarding the choice of operation, but rather to discuss resection from the point of view of mortality. Advocates of resection believe that the chronicity of ulcer is due to the corroding action of the acid chyme and that the way to cure the ulcer permanently is to remove as much as possible of the acid secreting portion of the stomach so that achlorhydria or hypo-acidity remains. This means a subtotal resection with the removal of two-thirds to three-quarters of the stomach. Surgeons who remove little more than the pyloric antrum (the alkaline secreting part of the stomach) and expect a high percentage of 5 year cures, will be woefully disappointed, and the figures will be used by others to discredit the procedure. In every large general hospital where many surgeons are operating, the difference in technique between the various surgeons is quite striking, and these differences must be reflected to

some degree in the mortality and the end-results.

In a recent article, George Heuer gives a classification of the operations he prefers for various types of peptic ulcer. For example he prefers a pyloroplasty for an ulcer on the anterior duodenal wall, a gastro enterostomy for an operation on the posterior wall, or if adhesions be present, also a gastro enterostomy for the calloused ulcer, occasionally a resection will be required. In bleeding cases the duodenum should be opened and the vessels sutured. For pyloric ulcers, pyloroplasty is suitable, for those higher up, excision and gastro-enterostomy, or pylorectomy. Where the ulcer is near the esophagus, gastro-enterostomy alone is sufficient. He states that the surgeon must approach each individual case with no preconceived ideas of the method he will employ. For jejunal ulcer following Billroth I type of resection, he recommends a posterior gastro-enterostomy with carefully regulated diet "as there is no assurance that a marginal ulcer will not form." For a marginal ulcer following a posterior gastro-enterostomy he advises disconnection of the anastomosis and excision of the jejunal ulcer with further strict future medical control. In other cases of marginal ulcer he recommends gastric resection. These suggestions appear to complicate unnecessarily what should be a simple problem.

Almost every medical treatment of gastric ulcer aims at lessening the acidity. Most of the operations endeavor to accomplish this same thing. It is generally recognized that ulcer is not a localized condition like a furuncle, but rather the objective finding in a systemic disease. Ulcer patients always have a gastritis, they almost always have hyperacidity, the acute exacerbations usually occur during periods of worry and overwork. A pylorectomy should never be done. It is a physiologically unsound operation as it removes the alkaline mucus secreting portion of the stomach. Excision of the ulcer does not

help the hyperacidity and will be followed by a high rate of recurrence. It has been given up in most clinics. Gastro enterostomy exposes the jejunal mucosa to the irritating digestive juices of the stomach against which it has no natural defence. There is no doubt that marginal ulcers are much commoner than some reports suggest.

It is probable that the etiological factors producing peptic ulcer are constant, and that hyperacidity is one of the most important of these factors. Wright, in a collective enquiry by the Fellows of the Association of Surgeons of Great Britain into gastric jejunal ulceration, in a follow up of 436 patients who had resection for gastric carcinoma, found none developed secondary ulceration. This is presumably because of the achlorhydria present in these cases. Most gastro enterologists doubt the curability of an ulcer patient who has a very high acidity, and most surgeons insist on a careful postoperative medical regimen if hyperacidity remains. They fear a recurrence.

The surest way of overcoming hyperacidity is excision of the acid secreting portion of the stomach, that is, the body, and in practice resection of two thirds of the stomach accomplishes this in the vast majority of cases. In addition to this, resection furnishes everything that can be expected from a gastro-enterostomy inasmuch as the stomach empties more quickly and some regurgitation of alkaline duodenal contents may occur.

Resection has been so invaluable in those cases of persistently recurrent ulcer following repeated previous operations that its place is recognized in this field by all. If it is good for the most intractable cases, it stands to reason it is equally useful for all cases. This is because it is a physiologically rational procedure.

The objections mainly heard to the routine use of resection are that the mortality is higher, anemia may follow and that it seems a shame to remove so much stomach for such a little ulcer. The last is purely a sentimental reason and can be ignored, as the ulcer is only a local sign of a diseased stomach.

The question of mortality is of great importance. If it cannot be kept below 5 per

cent the operation must be abandoned except in exceptional cases. In complicated cases such as marginal ulcer following a gastro-enterostomy, or a colicojejunal fistula, the mortality will naturally be high, but in simple uncomplicated resections the mortality can be kept between 2 and 3 per cent. This is a lower mortality than will be found when all ulcers are treated by a medical regimen. To attain such a low mortality the technique must be foolproof. The causes of death are usually postoperative shock, chest complications (collapse, pneumonia and empyema), leakage of the stoma and peritonitis, obstruction, vicious cycle, hemorrhage, evisceration with later obstruction, and rupture of the duodenal stump.

Causes of failure to relieve all gastrointestinal symptoms may be cited as small stomach symptoms, poor functioning of the stoma, recurrence of the ulcer, occurrence of marginal ulcer, and occasionally, perhaps, gastrocolic or jejunocolic fistula.

If surgeons could avoid these things, the mortality would be strikingly low, and the cures very high. The main purpose of this paper is to discuss these possible misadventures with a view to their control. It will be simplest to discuss them under the headings of pre-operative care, anesthetic, technique of operation, and postoperative care.

Pre-operative care is only occasionally of unusual importance. If emaciation is present, or marked anemia from one or more hemorrhages, or pyloric stenosis, special preliminary treatment must be taken.

If heart, lung, or kidney conditions are present which make major surgery unsuitable, it may be advisable to refuse operation, or to be satisfied with a merely palliative procedure, such as pyloroplasty.

For the average patient, well nourished, with a hemoglobin percentage of over 80, not complicated by pyloric obstruction, special pre-operative preparation is unnecessary. Extra glucose should be given for two days before operation to build up a glycogen reserve, and the stomach should be empty at operation. This usually occurs if nothing is administered by mouth after 6 p.m. the preceding evening.

When the patient is anemic, or emaciated, every effort should be made by extra feeding, intravenous glucose saline, and transfusions, to build up the patient's general state in order to turn a poor risk into a good one. In the presence of pyloric obstruction, a nasal catheter should be inserted into the stomach and repeated lavage carried out in order to empty the stomach and lessen the dilatation. Often, after a few days of this treatment, the spasm and edema of the pylorus will subside, the obstruction will be overcome and further care will greatly improve the general condition of the patient. After prolonged obstruction, repeated transfusions may be required before the patient is ready for operation.

I have used transfusions but rarely in the ordinary cases, either before operation or after, but in emaciated or markedly anemic patients their repeated use must be insisted upon.

Anesthesia The next important consideration is the choice of anesthetic. While local anesthesia is the anesthesia of choice, it is difficult to employ in many patients. The procedure is too nerve racking for both patient and surgeon. High nupercaine spinal anesthesia, followed by a later splanchnic nerve block, works almost as well. With this anesthetic also postoperative shock appears to be eliminated. The patients leave the operating room in about as good condition as they enter it, the pulse rate and blood pressure being approximately the same. Reports are frequently published showing a high percentage of chest complications following spinal anesthesia. Chest complications may occur comparatively frequently, but are almost invariably not serious. A severe postoperative pneumonia is almost unknown in our series. Spinal anesthesia further gives such perfect relaxation of the abdominal wall that the technical procedures are made much easier.

Splanchnic anesthesia appears to play a definite part in preventing shock. Whether because it prevents afferent autonomic impulses I cannot say. It certainly lessens the gagging and straining which so often occur when traction is made upon the stomach. The method used is simple. About 60 cubic centimeters of 0.5 per cent novocain, with adren-

alin, are injected retroperitoneally against the body of the twelfth thoracic vertebra, above the lesser curvature of the stomach, the needle entering between the aorta and the inferior vena cava. If the anesthetic wears off before the end of the operation, gas and oxygen anesthesia should be added. Cyclopropane anesthesia appears to increase bleeding.

With spinal anesthesia there is sometimes a considerable fall in blood pressure which may worry the anesthetist, but this gradually returns to normal during the operation. If it falls too low the head of the table should be lowered, and intravenous glucose saline administered.

Technique Detailed descriptions of the technique of gastric resection can be found in any of the larger works on surgery. The purpose in this paper is rather to emphasize such points as are felt to be of importance in lowering the mortality and in making a stoma which will work.

A midline incision from xiphoid to the left of the umbilicus is very satisfactory. It is quickly made, is almost bloodless, and if sutured carefully is only rarely followed by hernia. The appendix can be removed if desired, and the abdomen then explored. If an ulcer is found I resect unless this does not seem advisable because of unusual conditions. If no ulcer is found after a thorough exploration, including opening the stomach and duodenum widely and examining the mucosa thoroughly with the aid of a Cameron light, close up and call it a day, or do a simple pyloro-plasty if pyloric spasm appears to have been the cause of the symptoms. Operations for ulcer in the absence of ulcer do not cure the symptoms and are usually a boomerang which comes back to discredit surgery.

The first step when resection is decided upon is to bring up the jejunum into the wound and place a holding suture in it 3 inches below Treitz's ligament. A slit is then made in the mesocolon to the left of the midcolic artery and holding sutures are placed in each side of the slit. The transverse colon and small bowel are now placed back in the abdominal cavity and covered with a warm moist sponge.

If one resects for cancer it is important that the omentum be removed. For ulcer the

omentum must be carefully freed from the stomach in such a way that its blood supply is left intact, this means that the branches between the gastro epiploic and the stomach must be ligated separately but the gastro epiploic vessels themselves must not be damaged. The old method of tying the omentum in a few large bites leaves the omentum without adequate blood supply, if large it becomes cyanosed, and the trauma to it may be a cause of later shock.

The omentum is freed right down to the pancreas from the greater curvature and up to the bare area where the right and left gastro epiploic vessels meet. The pylorus and duodenum are then freed on the lesser curvature.

A simple way of inverting the duodenum is to make an incision round it down to the mucosa and to strip back the serosa from the mucosa. Place a pursestring suture half an inch below the edge of the stripped back area, doubly ligate the duodenum over the stripped mucosa and incise with a cautery between the ligatures. The distal stump is then inverted by the pursestring suture. This is further inverted by one or two continuous sutures and the stump is covered with loose peritoneum from the edge of the pancreas. This places the stump retroperitoneally and helps to localize small leaks so that an abscess is formed rather than general peritonitis. A gauze or protective covering is tied over the stomach stump to prevent soiling.

The stomach being used as a retractor, the lesser curvature is now cleared up to and including the left gastric artery. With the help of a De Petz sewing clamp, about two thirds to three quarters of the stomach is removed. The rule is "When in doubt as to how much to remove, remove more rather than less." If the stomach is dilated, a greater proportion of it must be removed as it is the antrum which dilates most.

Choosing a point about the middle of the stomach stump, two holding sutures are inserted, taking good bites of anterior and posterior wall of the stomach. These sutures are held until the whole anastomosis is completed. The rest of the stomach between these sutures and the lesser curvature is now closed and

inverted in two layers. The lesser curvature angle is most readily inverted by a U inversion suture running round the end.

The jejunum is now brought through the slit in the mesentery. The ligament of Treitz can be cut to prevent kinking of the jejunum at this point. The left edge of the slit in the mesentery is sutured to the posterior wall of the stomach, and the jejunum anastomosed to the stomach opening between the holding sutures and the greater curvature. Locking every stitch on the posterior layer, with a baseball stitch for the anterior wall, prevents hemorrhage. A scratch mark on the anti-mesenteric border of the jejunum is useful to prevent rotation during anastomosis. A no loop anastomosis is made, the proximal end of the anastomosis being less than 2 inches from the ligament of Treitz. This prevents possible kinking and torsion of the proximal loop. Two layers should be used in the anastomosis, and if it does not look perfect a few interrupted silk sutures can be inserted to cover any imperfections.

At the so called "fatal angle" where three suture lines meet, Finsterer's angle suture is valuable. He advises taking in a good bite of anterior and posterior wall of the stomach and two bites in the jejunum. This closes off the dangerous angle. A second similar suture is inserted beyond the first, nearer the lesser curvature. This not only prevents leakage at this point, but brings the jejunum up on to the closed portion of the stomach so that retrograde filling of the duodenal loop from the stomach is avoided. These two sutures there fore prevent leakage at this most dangerous angle, and prevent rupture of the duodenal stump due to retrograde flow—two common causes of death following gastric resection. Another similar smaller suture is placed in the stomach and jejunum to protect the other angle at the greater curvature. The right edge of the slit in the mesocolon is sutured to the anterior wall of the stomach. Another pursestring suture takes up the opening in the anterior layer of the omentum and fastens it up to the gastrohepatic omentum, giving additional support to the omentum.

Except for the continuous sutures in the actual anastomosis where catgut is used, the

silk is used throughout. There are several steps in the above description which may be emphasized.

1 Burying the duodenal stump behind the peritoneum helps to localize infection if leakage should occur and to delay or prevent general peritonitis.

2 The double pursestring suture about the "fatal" angle absolutely prevents leakage.

3 Ligating the branches of the gastro-epiploic vessels protects the blood supply of the omentum and lessens shock.

4 The no-loop anastomosis, together with bringing up the afferent loop over the closed end of the stomach stump prevents retrograde filling of the duodenum and also torsion and volvulus of the duodenum and jejunum forming the loop.

5 The anastomosis is situated in the greater peritoneal cavity, thus lessening danger of death if leakage should occur.

6 The baseball and locked anastomotic sutures prevent hemorrhage.

This technique is satisfactory for simple ulcers, but in complicated ulcers new problems present themselves. Where the ulcer is penetrating adjacent viscera they should be dissected off and the bed of the ulcer left intact. In these cases a drain should be inserted, especially if the ulcer penetrates the pancreas. A quantity of pancreatic secretion, if allowed to collect, might digest the suture line and cause a perforation.

When a large duodenal ulcer is present it may be impossible to resect below it without endangering the common duct. In these cases Finsterer's operation for exclusion is invaluable. The stomach is incised above the pylorus, leaving the ulcer *in situ*. The stump can be easily closed by dissecting away the mucosa and suturing the raw edges together. The ulcer removed from the digestive action of the gastric juice will promptly heal.

If the stomach ulcer is so high, or near the esophagus that one cannot resect above it, resect below it, taking away as much stomach as possible, but ensuring that the anastomosis be made in healthy tissue.

When dealing with a marginal ulcer, two methods are available. The first is resection of the stomach and that portion of the

jejunum involved. The jejunum is reunited by end-to-end anastomosis, and then the jejunum is anastomosed to the stomach as described above. The mortality for this operation is naturally higher.

Dr F A C Scrimger has designed an operation he considers safer, following the idea of Finsterer's operation for exclusion. He cuts around the stomach an inch or more above the stoma, dissects out the mucosa down to the jejunum, and closes the cuff of stomach serosa, accompanying this with a resection. While this, like Finsterer's operation for exclusion, is often a splendid and life-saving procedure, I think it is a good rule to follow that the ulcer should be removed, if possible. Ulcers left in have been known to bleed and even to perforate during the early postoperative days.

In cases of gastrocolic fistula, do not resect the colon if it can be avoided. Resection of stomach, jejunum, and colon is always a hazardous procedure. If the colon can be dissected off the ulcer and the opening can be inverted, this should be done. Great care must be taken to prevent soiling. If the colon has to be resected a lower mortality will probably be obtained if the ends of the colon are brought out of the wound after being sutured together to form a spur. The colostomy can then be closed later. This has been advocated by Lahey in all large bowel resections, and he claims a very low mortality.

Infection from opening the stomach or duodenum in ulcer cases with high acidity is a rare occurrence, and one need never hesitate to open the stomach freely to explore it for a doubtful ulcer.

Postoperative care. On return from the operating room the patient is kept warm and immediately given 1000 cubic centimeters of 5 per cent glucose saline intravenously. Sufficient morphine is given to keep the patient comfortable. The glucose saline infusions are given twice a day until the patient is able to take sufficient fluid by mouth to maintain his fluid balance. Nothing is given by mouth for 24 hours, then 1 ounce of water is given every hour during the second day, 1 ounce every half hour during the third day. After this the diet is gradually increased until by the tenth

day the patient is on restricted diet, with extra feedings between meals. He may get up on the twelfth day and go home on the fourteenth on full diet. Most of our patients go home on the twelfth day.

The carbon dioxide rebreathing bag is given routinely for a few minutes several times a day for the first few days to ensure lung ventilation and to prevent postoperative atelectasis, the precursor of postoperative pneumonia. A nasal catheter is inserted at the slightest sign of nausea, vomiting, or epigastric fullness.

If these methods be exactly followed the mortality can be kept down to well below 5 per cent and in uncomplicated cases to about 2 to 3 per cent. The permanent cures, if sufficient stomach is removed, will be well over 90 per cent.

So many questions are asked about postoperative anemia following resection, that brief mention of it should be made. The great majority of our cases have shown no anemia following resection. This means simply that anemia is not caused by resection, otherwise it would be inevitable.

Some English surgeons have suggested that the anemia is a deficiency anemia due to rapid transit of food from the stomach to the colon with failure of absorption. With this I am inclined to agree. The one case in our series showing a 50 per cent hemoglobin was living on an inadequate milk diet. Ingested barium reached her colon in less than 3 hours. Put on a regular diet, with steak and French fried

potatoes, and good solid meals, she rapidly improved and has now a hemoglobin approaching 100 per cent. This is the reason I am opposed to the Polya type of operation where the jejunum is anastomosed to the whole length of stomach stump. Food, especially liquid food, goes right into the jejunum, and passes rapidly into the colon. Reports have shown that anemia after this type of operation is higher than following the Hofmeister Finsterer modification of Billroth II which is the operation here described.

CONCLUSIONS

In conclusion may it be again stated that if surgery is going to cure ulcer it must be adequate surgery. The surest way to keep down acid (the agreed cause of chronicity) is to remove as much as possible of the acid secreting portion of the stomach. Do a gastro enterostomy and a certain percentage of marginal ulcers occurs. Add an entero enterostomy (leading the alkaline neutralizing fluids of the duodenum away from the stoma) and you more than double the incidence of marginal ulcer. The jejunal mucosa can no longer resist the corroding effect of the acid chyme. Given a patient with hyperacidity over a hundred, cure is impossible until achlorhydria or at least a low acid is obtained.

REFERENCES

1. HEGER GEORGE. New York State J Med 1935 35 1
2. SCRIMMER F A C. Personal communication
3. WRIGHT Brit J Surg 1935, 22 433

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF MICHIGAN

THE DEVELOPMENT OF THE TECHNIQUE OF THYROIDECTOMY

Presentation of Method Used in University Hospital

FREDERICK A. COLLIER, M.D., F.A.C.S., and ALLEN M. BOYDEN, M.D., Ann Arbor, Michigan

THE development of surgery of the thyroid is one of the most fascinating chapters in the history of surgery. The details of attempts to remove goiters in the years before the discovery of anesthesia, the development of hemostatic forceps, and the enunciation of the concept of antiseptic and aseptic surgery are almost too ghastly and horrible to believe. The operation was fraught with such danger that it was performed only in cases presenting severe suffocative symptoms. The mortality was unbelievably high.

With the advent of anesthesia (1846), with Lister's memorable discovery of antiseptics (1867) shortly to be replaced by asepsis, and with the acceptance and use of the hemostatic forceps in European clinics (about 1870), deliberate and elective surgical attack on diseases of the thyroid gland progressed rapidly. One needs but glance at the increasing number of goiter operations and the decreasing mortality during the third and early part of the fourth quarters of the nineteenth century to realize the tremendous impetus that these three epoch-making discoveries gave to surgery. Before 1850 about 70 goiter extirpations are known to have been performed with a mortality of 41 per cent (6). Kocher collected 146 cases in which operations were done, between 1850 and 1877, in this series the mortality had decreased to 21.2 per cent. In 1884 Kocher's own mortality in 43 cases had fallen to 6.9 per cent. In 1889 he reported 250 additional cases with 2.4 per cent mortality. By 1895 his mortality in non-malignant cases had fallen to a little over 1 per cent and in a new series of 560 non-malignant cases reported in 1898 to 0.18 per cent (7).

Gradually during this formative period the essentials of the technique of thyroidectomy as it is practiced today were evolved. Although the

admirable and courageous work of the great pioneers in thyroid surgery of France, Britain, Italy, and America (including such names as Desault, Dupuytren, Porta, Bottini, Watson, Nathan Smith, and William Green) must not be disregarded, practically all of the major advances in thyroid surgery were propounded by surgeons of the Teutonic countries—Germany, Switzerland, and Austria.

In pre-antiseptic days the contributions of Hedenus, von Bruns, and Sick are outstanding. With the discovery of antiseptics the advance of surgery received great impetus. The teachings of Lister, disregarded by the majority of surgeons in England and America for nearly a quarter of a century, were quickly accepted by most of the better surgeons of Germany, Austria, and Switzerland, and with the ever-diminishing mortality from sepsis they were encouraged to advocate the operation in all cases of goiter instead of merely accepting for surgery those which presented symptoms of suffocation.

Billroth, early in his career in pre-antiseptic years, became discouraged with the operative treatment of thyroid disease and did not seriously reconsider it until about 1877 (8). Thereafter his success was remarkable and his work greatly conducive to improvements in this field.

Greatest credit, however, is due Theodor Kocher for increasing our knowledge of thyroid surgery. Called to the chair of surgery at the University of Bern in 1872, at the age of 31 years, and spurred on by the success of his predecessor, Lucke, in the operative treatment of goiter, Kocher rapidly collected a series of cases which, both in number and in decreasing mortality, soon far surpassed his contemporaries on the continent. Halsted (9) lists his contributions to the subject as follows: (1) Discovery of the fact that total extirpation of

the thyroid gland is followed by body changes to which he gave the name thyreo- or strumi priva, (2) the studies with his life long friend Langhans of malignant tumors of the thyroid gland, (3) the perfecting of the operation of thyroidectomy, (4) the stimulus which he gave to the operative treatment of Graves' disease and to the study of the milder forms of hyperthyroidism, (5) the recognition of engrafted forms of Graves' disease (6) the demonstration of the value of the ligation of the arteries as a preliminary step to lobectomy in the highly toxic cases, and (7) the danger of the indiscriminate administration of iodine to patients with goiter. To these may be added several others (19). He did much to simplify the antiseptic method and develop the aseptic technique. His studies in the anatomy of the more or less constant vascular arrangement of the gland are noteworthy. One of the first to make critical follow up studies on his cases, he stressed the necessity for this type of investigation and demonstrated its importance. He emphasized the value of iodine as a goiter preventive measure.

Of particular interest are the technical advances made during this revolutionary period. In 1874 Kocher (10), operating either through a longitudinal incision along the edge of the sternomastoid muscle or through the midline, extirpated the gland from within its intrinsic capsule, accomplishing hemostasis posteriorly by dividing the pedicle like binding strands into two to six parts before tying. He usually dealt with the isthmus by ligation *in toto*. This was also essentially the technique of Billroth at that time.

In 1883 he advocated the 'Winkelschnitt' incision (11) which combined a midline vertical incision from sternum to cricoid cartilage with an oblique incision extending upward from the cricoid to the anterior border of the sternomastoid. The anterior and oblique jugular veins were ligated at the outset, and the sternohyoid, sternothyroid and omohyoid muscles were divided in line with the oblique incision. He then ligated the superior pole vessels, the lateral veins and the veins springing from the lower border of the lobe and isthmus, freeing the lobe completely, subsequent to which the inferior thyroid artery was isolated and ligated as close as possible to the carotid to prevent injury to the recurrent nerve. Then working carefully along the posterior capsule he freed the whole lobe and severed the isthmus securing its vessels as they were divided. Thus Kocher prevented to a large degree injury to the recurrent laryngeal nerve so common an occurrence in Billroth's clinic. The progress along technical lines in the 9 years is amazing.

Because of the occurrence of 'cachexia strumipriva' (named and described by Kocher in 1883) following total extirpation, Kocher strongly advocated lobectomy, reserving removal of both lobes for malignancy or the very unusual case in which removal of one lobe did not suffice to free the trachea. He retained this opinion until his death in 1917 (12).

The symptoms of tetany, first described by Wolsfer (13) in reporting on Billroth's clinic in 1870, occurred in evanescent form in total extirpations reported by Kocher (14). He considered it the acute form of the cachexia. The correct etiological factors in tetany and cachexia strumipriva were not understood, of course until the observations of Gley in 1897 (19) and Murray in 1892 (15).

In 1898 Kocher (16) advocated three distinctive features of the method then in use at Bern. The first of these was the transverse collar incision in the normal lines of skin cleavage. First described by Boeckel in 1885 (19), it was popularized by Kocher and bears the latter's name. Second, the sternohyoid and sternothyroid muscles were not divided transversely but merely separated and freed sufficiently at their upper ends for exposure, thus insuring their nerve supply. The third essential step was the luxation of the gland toward the medial side, accomplished after ligating the accessory veins, thus simplifying ligation of the main vessels.

One other name deserves more than passing mention during this period. In 1886 Johann von Mikulicz (17) director of the surgical clinic of Krakau, in order to avoid the unpleasant complication of recurrent nerve palsy and to reduce the incidence of cachexia strumipriva in those patients in whom it became necessary to remove the second lobe, described the operation of "re-ecution." This procedure differed from extirpation in that after ligating the superior pole vessels and veins to the lower pole of the lobe, and after dissecting the isthmus from the trachea anteriorly and laterally, the remaining attachment of the lobe lying in the tracheo-esophageal angle was divided into several parts crushed with hemostatic forceps, and ligated in the line of these 'clamp-made furrows'. The recurrent nerve and inferior thyroid artery were not seen.

Mikulicz did not advocate this method because he considered it necessary to leave a portion of thyroid tissue as such. He did not consider the gland a vital organ and failed to relate the symptoms of cachexia strumipriva to a lack of thyroid secretion. He feared recurrence of the goiter and injury to the recurrent nerve and he had learned

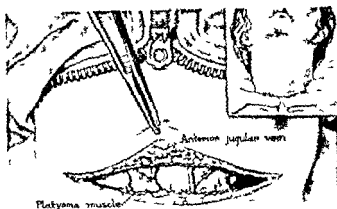


Fig. 1 The exposure obtained by our method of draping is well shown. The insert demonstrates the level of the transverse incision which is carried through subcutaneous fat and platysma. The anterior jugular veins remain unmolested.

through experience that it was often necessary to remove more than one lobe in order to relieve tracheal pressure and that cachexia strumipriva and tetany did not occur if a portion of one lobe remained.

To Mikulicz goes the credit not only for advocating and appreciating the value of resection in contradistinction to extirpation of the thyroid but also for discovering that masses of thyroid tissue might be crushed and ligated with impunity. His method embodies all of the main essentials of thyroidectomy as practiced today.

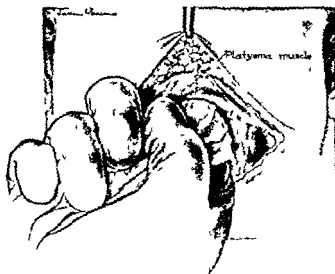


Fig. 3 The use of sharp dissection in raising the upper flap of skin and platysma is avoided. This maneuver can quickly be accomplished by the use of gauze over the gloved finger, with a minimum of trauma and bleeding.

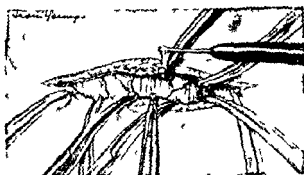


Fig. 2 The small blood vessels in subcutaneous tissue and platysma muscle are controlled by electrocoagulation in order to avoid in the superficial layers the use of catgut or other suture material so commonly the cause of serum collection beneath the flap after operation.

No résumé of the development of thyroidectomy is complete without mentioning the many contributions of Halsted, who did more to standardize technique and stimulate advance in surgery in the United States than any other individual. He followed constantly at first hand the progress being made on the continent and incorporated the improvements of such men as Kocher, Billroth, and Mikulicz into a well blended whole, adding from an ingenious mind and from increasing experience many subtle changes. His experimental work with thyroid and more particularly parathyroid grafts is monumental. In 1879 he popularized the use of hemostatic forceps in this country and designed the more delicate form of this instrument which still bears his name. His originally designed retractors, ligature carriers, aneurism needles, scalpels, and dissectors, all introduced in 1888 to 1889, were innovations of real

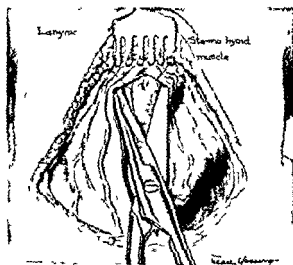


Fig. 4 The deep cervical fascia and sternohyoid muscles are separated in the midline to a point well above the thyroid notch and downward into the sternal notch. The skin flap retracted by assistant by means of Murphy retractor.

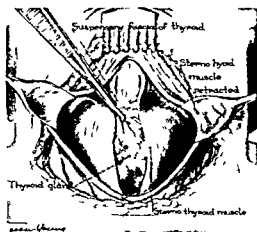


Fig 5 The sternohyoid muscles have been separated from the underlying sternothyroid muscles to show the relationship of the latter situated somewhat more laterally and clinging closely to the gland. This maneuver is shown merely to clarify anatomical landmarks and is of course not done at operation. The suspensory fascia of the thyroid is well demonstrated.

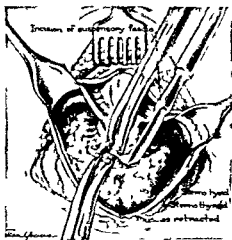


Fig 6 The sternohyoid muscles and sternothyroid muscles are retracted together by means of Brewster retractors thus exposing the upper poles of the thyroid. The suspensory fascia has been divided and the upper tracheal rings are exposed beneath the isthmus—a helpful landmark as the operation progresses.

importance. In 1881 he introduced the rubber tissue drain. In 1884 he was among the first to use transfusion of defibrinated blood. In 1885 he became the pioneer in local infiltration anesthesia. In 1890 he introduced rubber gloves.

Halsted's technique of thyroidectomy based on sound anatomical and physiological principles, was a refinement which has been improved upon but little (18). Through a collar incision and by separating the prethyroid muscle in the midline,

the thyroid was exposed. The superior pole was freed and divided between clamps placed 1 centimeter distal to the entrance of the pole vessels and applied from the lateral side. As the gland was rolled medially the extrinsic capsule was divided and brushed back, following which a series of fine artery clamps were applied on the posterolateral border of the gland defining the area to be resected. The lobe was then dropped back the isthmus was separated from the trachea by a blunt dissector and divided after three or four vessels on its anterior surface had been clamped. Resection of the lobe was carried out from within outward just distal to the encircling clamps. These were secured by a whip stitch along the capsule and any residual oozing checked by transfixion stitches in the stump. All layers, including platysma were closed separately with interrupted fine silk. Drainage was not used.

The special features of this operation which were more or less novel at the time of their introduction into the Johns Hopkins Clinic were enumerated by Halsted as follows: (1) preservation of the superficial veins of the neck, (2) no muscle except the platysma is divided—not even the sternohyoid except in case of large or adherent goiters, (3) the sternohyoid muscle is retracted outward—occasionally split longitudinally, (4) delivery and division of the superior pole before the remainder of the gland is dislocated, (5) resection in place of total lobectomy in order to protect the parathyroid glands and the recurrent laryngeal

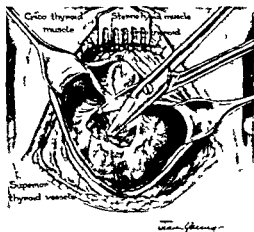


Fig 7 The cricothyroid space is being opened. When completed this maneuver allows mobilization of the upper pole and avoids injury both to the recurrent nerve as it dips beneath the thyroid cartilage into the larynx and to the branches of the superior laryngeal nerve.

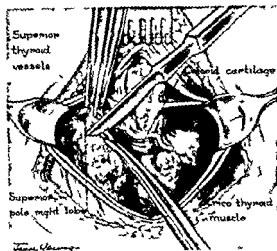


Fig. 8 The superior pole has been mobilized both medially and laterally. The superior thyroid vessels are divided between clamps, only the vessels themselves being grasped. No thyroid tissue is left at the superior pole.

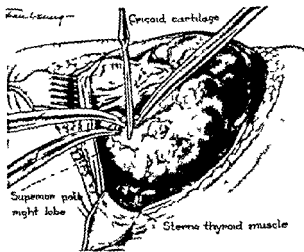


Fig. 9 Lateral view (from position of operator) of same maneuver as demonstrated in Figure 8. It should be noted that the superior vessels are clamped on the anterior surface of the pole.

nerve and to preserve a slice of thyroid in case an operation might have to be performed on the opposite lobe, possibly by another surgeon, (6) ultraligation (well beyond the origin of the parathyroid arteries) of the blood vessels, all of which are clamped before the lobe is resected, (7) ligation of the inferior thyroid artery is not practiced, (8) closure of the wound without drainage, made possible by the use of fine silk and the transfixion method for the absolute arrest of hemorrhage.

In Halsted's clinic unilateral resection was practiced in the severe cases of exophthalmic goiter while bilateral resection was performed in colloid goiters, diffuse "conglomerate" adenomatous goiters, and in the milder forms of Graves' disease. Large discrete adenomas were enucleated in a unique manner.

American surgeons, following the lead of Halsted, rapidly improved their methods until the procedure of thyroidectomy became more or less standardized. In its many minutiae the operation varies considerably in different hands, but the essentials of the technique remain the same. During recent years many surgeons have detoured modifications in procedure which from their experience have proved most satisfactory, and it is interesting to note the many variations in approach and minute technique which are being practiced in this field today.

The complications of recurrent nerve paralysis and postoperative tetany have remained of great importance, although the incidence of both has been greatly reduced with improvement in method. Permanent parathyroid tetany has become a rarity. The incidence of recurrent nerve injury, however, is most difficult to ascertain

from the literature and would probably prove to be surprisingly high were all cases subjected to examination of the larynx before and after operation. The more recent anatomical contributions of Fowler and Hanson, Nordland, and Roeder (24), clarifying the relationships of the pretracheal fascia to the thyroid and recurrent nerves as well as the variations in relationship of this nerve normally and in cases with marked enlargement of the thyroid, particularly substernal adenomas, should prove of value in reducing the incidence of this complication. The danger of tension on the nerve by rough and excessive rotation of the lobe has been emphasized by Crile.

In recent years the superior laryngeal nerve has received considerable attention and the effects of its section or injury have been noted both experimentally and clinically. Fowler emphasized

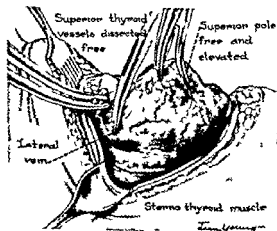


Fig. 10 The superior thyroid vessels have been divided thus allowing the pole to be dislocated anteriorly. The lateral vein is divided as this is being accomplished so that the superior pole is completely mobilized.

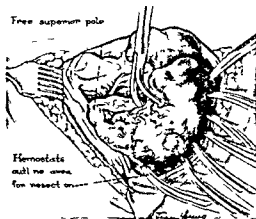


Fig. 11. Clamps have been placed on posterolateral aspect of lobe to designate line of resection. In substernal goiters after upper pole is freed enough mobility of lobe is obtained to permit delivery of substernal portion into wound without difficulty before these clamps are applied.

the close proximity of this nerve to the superior thyroid vessels and suggested that injury to it might result in minor vocal changes. Berlin and Lahey (1) pointed out the fact that in practically all instances the interarticular muscle is innervated by the internal branch of the superior laryngeal nerve. This finding has been corroborated by the dissections of Nordland. Roeder (24) pointed out the possible effects of injury of the branches of the superior laryngeal nerve and advocated a method of delivering the superior pole to prevent

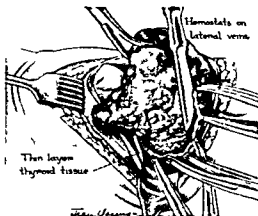


Fig. 12. Resection is started. A thin shell of thyroid tissue and posterior thyroid capsule is left in order to protect the parathyroid muscles and the recurrent nerves. Note that the line of resection begins below the superior pole.

such injuries. In a recent paper Eades re-emphasized the importance of guarding against damage to this nerve and presented a variation in technical approach to the superior pole averting this complication. Johnson has demonstrated on cats the effect of such injury by the production of mucus plugs in the trachea and larynx after severance of this nerve and the stimulation of either the peripheral or central ends of the divided nerve.

UNIVERSITY HOSPITAL TECHNIQUE

For many years the technique of thyroidectomy as practiced in the University Hospital has been a standardized procedure. Because of the fact that we have been unable to find in the literature a

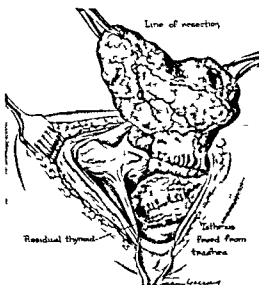


Fig. 13. Resection of right lobe has been completed and the isthmus has been dissected free from the trachea. The amount of residual thyroid is demonstrated.

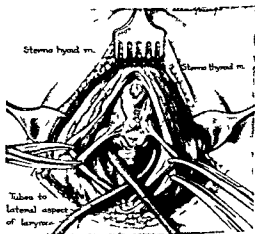


Fig. 14. Bilateral resection has been completed. Small rubber tube drains are placed in dead space left at the lateral aspect of the larynx.

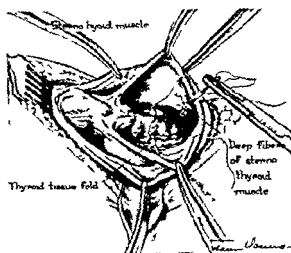


Fig. 15 The deep fibers of the sternothyroid muscles are being approximated. This step is of importance since it allows more complete obliteration of the dead space which remains following resection.

description of the operation as it is performed at the University Hospital, and because it combines many technical features which have proved to be particularly advantageous, we believe it worth while to present this technique in considerable detail.

The zipper sheet used for draping (Fig. 1) has been previously described in detail (2). The advantages of this device are simplicity of application, more thorough asepsis in the operative field since it fits snugly around the neck and covers the anesthetist without the inconvenience of a metal hoop or other appliance over the patient's

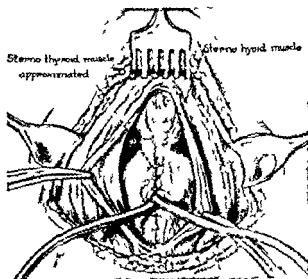


Fig. 16 The sternothyroid muscles are approximated in the midline to provide more adequate covering for the trachea as well as to obliterate dead space. Drains cross in the midline.

head, more adequate space for operator and assistants.

The Kocher incision is made approximately one finger's breadth above the upper borders of the inner ends of the clavicle (Fig. 1) and is curved very slightly with the convexity downward. Oftentimes it is practically straight when the head is markedly extended, becoming slightly convex when the head is held in the normal attitude. The platysma is divided transversely (Fig. 1). Superficial blood vessels in subcutaneous fat and platysma are coagulated by means of the Bovie unit (Fig. 2). It is our distinct feeling that the collection of serum beneath the flap is most often the result of catgut sutures placed in this region and that this complication is minimized by the use of electrocoagulation. It is also a time saving device. The upper flap of skin and platysma is readily dissected upward from the deep fascia to just above the thyroid notch with a minimum of bleeding by means of a piece of gauze

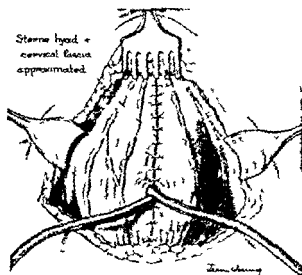


Fig. 17 Sternohyoid muscles and deep cervical fascia approximated with interrupted sutures. Contrary to the illustration the knots are buried beneath this layer to avoid excessive suture material beneath the skin platysma flap. Only five to six sutures are necessary for this procedure.

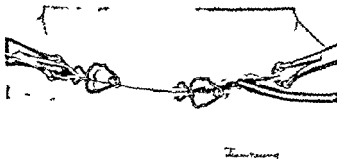


Fig. 18 Towel clips grasp the angles of the incision for traction to facilitate accurate application of skin clips. The drains are brought out at the angles.

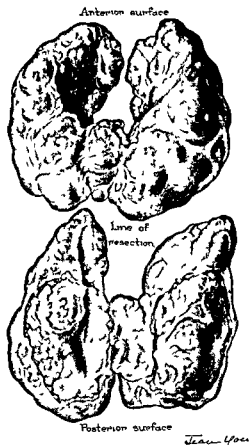


Fig. 10. Anterior and posterior aspects of the resected gland. The line of resection and the amount of thyroid tissue removed are demonstrated.

over the gloved finger (Fig. 3). It is then retracted by means of the Murphy rake held by an assistant (Fig. 4). The lower flap and the anterior jugular veins are not molested, minimizing the danger of air embolus.

The deep cervical fascia is divided in the midline (Fig. 4) to a point slightly above the thyroid notch, thus exposing the isthmus of the thyroid. This permits retraction of the sternohyoid muscles and exposes the lobes of the thyroid covered by sternohyoid muscles which lie somewhat more laterally (Fig. 5). These muscles are now carefully separated from the thyroid lobes and retracted laterally with the sternohyoids and deep cervical fascia by means of a Brewster retractor, the gentle concavity of which permits depression of its handle posteriorly to allow easy access to the lobe. The retractor is used only on one side and after lobectomy is transferred to the opposite side, two retractors having been shown

in the illustration for the sake of clarity. Even in many large goiters the exposure afforded by this means proves sufficient. However, we do not hesitate to divide the muscles transversely when occasion demands. Transverse division of the deep cervical fascia and reflection upward with platysma as advocated by Reeder (23) compels the unnecessary ligation of the anterior jugular veins and adds little to the exposure.

With both muscles thus retracted the suspensory fascia of the thyroid (Fig. 5) is divided above the isthmus and the upper tracheal rings exposed as a landmark for future reference (Fig. 6). At this juncture should a pyramidal lobe be found it is freed completely. After exposure of the tracheal rings above the isthmus it is easy by means of blunt dissection to define the cricothyroid space lying between the medial aspect of the upper pole and the thin fascia covering the cricothyroid muscle (Fig. 7). This space can be opened without fear of injury to the superior thyroid vessels and permits complete separation of the superior pole from the larynx, thus avoiding injury to the branches of the superior laryngeal nerve as they enter the larynx and cricothyroid muscle.

The superior thyroid vessels, lying on the anterior surface of the pole, are readily divided between clamps (Figs. 8 and 9) permitting complete delivery of this structure by dislocating it from its bed and pulling it anteriorly by means of tenacula or ordinary towel clips (Fig. 10). As this is being accomplished the lateral vein is divided as well. This dissection is carried out just beneath the immediate fascial covering and, if done carefully, eliminates the possibility of injury to the branches of the superior laryngeal nerve. Only the superior thyroid vessels are included in the hemostats, the pole being delivered in its entirety. The clamps on the superior thyroid vessels and lateral vein are not tied until complete resection of the lobe has been accomplished. Although again this has been depicted in order to simplify the illustrations.

This method of delivery of the pole is somewhat similar to that recently described by Eades. However, there is no other reference in the literature to a corresponding procedure.

After the upper pole has been released in this manner it is almost always possible to deliver the remainder of the lobe into the wound even though it may lie deep beneath the sternum. If the lower pole cannot be delivered at this point by gentle traction the resection of the gland is carried on from above and laterally until a point is reached where the lower pole can be delivered. If it is borne in mind that substernal prolongations of the

lobe do not have substernal anatomical attachments, it can be seen that after freeing the normal cervical attachments the lower pole should be easily delivered. We have yet to encounter a lobe with cervical attachments that could not be removed in this manner. Hemostats are now placed on the lateral surface of the lobe to outline the area for resection (Fig. 11), and a thin layer of thyroid tissue is left with the posterior thyroid capsule to protect the parathyroid bodies and the recurrent nerve (Fig. 12). This dissection is carried out from the lateral side and is guided as the trachea is approached by the view of the upper tracheal rings exposed earlier in the dissection. The isthmus in its entirety is dissected carefully from the trachea along the areolar plane lying between these structures (Fig. 13). We believe that this step results in less chance for adhesion of the trachea to the prethyroid muscles and is less productive of tracheitis than though thyroid tissue is left on the trachea.

The amount of thyroid tissue which should be left after thyroidectomy is difficult to describe. It is our practice to leave only a small fraction of the total gland, the exact amount varying somewhat with the type of disease. This can best be demonstrated by referring to Figures 13 and 19.

Hemostasis is accomplished by means of fine catgut ligatures and sutures, the clamps on the superior thyroid vessels ligated last to provide greatest exposure. The remaining thyroid tissue is not folded over on itself or sutured over the trachea because of danger of producing torsion of the recurrent nerves. This possibility has been emphasized by Noehren. The use of fine silk in the thyroid bed has been largely abandoned. Its use has proved of no real advantage when weighed against the fact that it is quite definitely more time consuming.

In reviewing the literature we have found wide differences of opinion regarding drainage following resection. Since it is impossible to obliterate completely the dead space lateral to the trachea and larynx following extirpation we continue to drain practically all of our cases. Drainage is accomplished by means of small soft rubber tubes placed on each side of the larynx, crossing in the midline as they emerge from the prethyroid muscles, and brought out at the angles of the skin incision (Figs. 14, 16, 17, and 18). The drains are removed in 6 to 12 hours. We avoid drainage through the midline because approximation of the skin is apt to be less exact at the site of drainage with a resultant irregular scar. It is of particular importance to avoid midline drains in women since in the midline of the neck the subcutaneous fat pad is

approximately twice as thick as it is lateral to this point. Accurate restoration of this fat pad is essential to a slightly scar.

The prethyroid muscles are sutured in two layers over the trachea. In suturing the sternothyroid muscle the deep fibers of the muscle are approximated without tension (Figs. 15 and 16), in order to close more completely the dead space left by removal of the thyroid lobes. This maneuver is particularly advantageous in cases of substernal goiter as its use will obliterate the cavity in the upper thoracic strait that usually fills with serum and blood. This muscle, drawn snugly over the thyroid residue, acts as a hemostatic agent, provides added protection for the trachea, and prevents the formation of adhesions between the trachea and superficial layers, which may result in the annoying scar which moves with deglutition. In suturing the sternohyoid and deep cervical fascia we bury the knots in an attempt to prevent serum accumulations beneath the skin flap (Fig. 17). Suture of the platysma separately is not practiced since it merely necessitates the placing of more foreign material in the wound. The skin is closed with either the Herff (Fig. 18) or Michel clips, one half of which are removed on the first and the remainder on the second post-operative day.

SUMMARY

The development of the technique of thyroidectomy has been reviewed briefly with particular reference to the advances made by Kocher, Mikulicz, and Halsted. The importance of the superior laryngeal nerves in thyroidectomy has been emphasized. The technique of thyroidectomy as practiced at the University Hospital has been given in detail and illustrated, with particular emphasis on the method of attack on the superior pole.

BIBLIOGRAPHY

1. BERLIN, D. and LAHEY, F. H. Dissections of recurrent and superior laryngeal nerves: relation of recurrent to inferior thyroid artery and relation of superior to abductor paralysis. *Surg., Gynec. & Obst.*, 1929, 49, 102-104.
2. COLLIER, F. A. Method of draping for operations on neck. *Am. J. Surg.* 1930, 8, 46-47.
3. CRILE, G. W. Prevention of abductor paralysis in thyroidectomy. *Surg., Gynec. & Obst.* 1929, 49, 538-539.
4. EADES, C. C. Enucleation of superior thyroid pole. *Am. J. Surg.* 1936, 34, 201-205.
5. FOWLER, C. H. and HANSON, W. A. Surgical anatomy of thyroid gland with special reference to relations of recurrent laryngeal nerve. *Surg., Gynec. & Obst.* 1929, 49, 59-65.
6. HALSTED, W. S. Operative story of goiter. *Johns Hopkins Hosp. Rep.*, 1920, 19, 169.
7. *Ibid.* pp. 169, 175, 176, 177.

- 8 HALSTED W S Operative story of thyroid loc cit
pp 150 158 166
- 9 Ibid p 165
- 10 Ibid pp 166 167
- 11 Ibid pp 170 171
- 12 Ibid pp 172 177
- 13 Ibid p 153
- 14 Ibid p 175
- 15 Ibid p 167
- 16 Ibid pp 176 177
- 17 Ibid p 187
- 18 Ibid pp 193 194 195
- 19 HEGNER CASPER F History of thyroid surgery Ann
Surg 1932 95 481-492
- 20 JOHNSON J Effect of superior laryngeal nerves on
the tracheal mucus experimental study to deter-
mine their relationship Ann Surg 1935 101
494-499
- 21 NOELHREN A H Prevention of injury to recurrent
laryngeal nerves during thyroidectomy New York
State J Med 1931 31 410-412
- 22 NORDLAND, M Larynx as related to surgery of thy-
roid based on anatomical study Surg Gynec &
Obst 1930 51 440-450
- 23 ROEDER C A Thyroidectomy J Am M Ass 1922
79 2066-2068
- 24 Idem Operations on superior pole of thyroid Arch
Surg 1932 24 426-439

CARCINOMA OF COLON

Treatment Depending on Location of Lesion

MOSES BEHREND, M D, F A C S, Philadelphia, Pennsylvania

THE symptoms of carcinoma of the colon in the early stages are rather elusive. There are, as a matter of fact, no specific signs that would lead one to suspect the existence of a grave lesion and thus make an early diagnosis of this disease possible. There should be no difficulty, however, in making a correct diagnosis when the late symptoms—blood, mucus, and the discharge of pus in the stools occur. Occasionally pain, tenderness, and rigidity may furnish the clue as to the nature of the lesion, but these symptoms are too often masked by the seemingly fine state of health of the individual, giving no evidence of any serious condition. The x-ray here could be of great help and should always be considered to clear the situation.

Histories, in a critical review of 158 cases, showed that progressive constipation, diarrhea, followed by constipation, must be looked upon with suspicion. A change in bowel habit, backache, and especially pain are suggestive of serious trouble. Late in the disease, in addition to these symptoms, there will occur a marked anemia tinged with cachexia, and generalized weakness.

Pettinari points out that obstinate diarrhea is the chief symptom of rectal carcinoma. H. M. Weber states that any changes in intestinal habit are indications for a thorough x-ray investigation of the intestinal tract.

SYMPTOMS DEPENDENT ON LOCATION OF LESION

Symptoms depend both on the character and the location of the lesion in the colon. When the lesion occurs in the region of the cecum, symptoms of appendicitis may suddenly appear due to the inflammation surrounding the cancer. A mass is felt, often ascribed to the presence of an appendiceal abscess. When the abdomen is opened, the true nature of the cause that gave rise to the symptoms is revealed. The same may be said of carcinoma in the ascending and hepatic flexures of the colon. When the tumor occurs in the descending colon where the constrictive type of carcinoma is generally found, obstructive symp-

toms and increasing constipation should lead to the diagnosis. In the rectum and the lower sigmoid where the ulcerative type of lesion is encountered, associated pain is more frequent than in other locations, save the constrictive type. Vague symptoms may last for years until the sudden onset of definite signs reveals the catastrophe. It is my firm belief that in the constrictive type, symptoms may begin at least 5 years before any outward signs are apparent, although Crafoord and others have observed that 7 to 9 months is the average lapse between initial symptoms and the diagnosis. A history of increasing constipation and symptoms of chronic intestinal obstruction then, must always be viewed with suspicion as the resultant of some grave lesion of the intestinal tract. For example, a patient recently admitted for operation had signs of chronic intestinal obstruction for 18 months (Fig. 1). The lesion was in the splenic flexure, apposing the diaphragm. The radiologist reported no obstructive lesion present. At operation we found an adherent tumor in the region of the left lumbocostal arch of the diaphragm. Colostomy was performed, but the patient's tissues were so devitalized as to prevent agglutination of the gut to the abdominal wound. He died before a second operation could be performed. In the ulcerative forms of the disease symptoms appear from 1 to 3 years before late symptoms arise.

FREQUENCY AND LOCATION OF LESION

It is a well known fact that there is an appalling increase in the number of cases of cancer of the colon. Dr. Dixon, of the Mayo Clinic, states that "in the year 1935 the largest number of surgical conditions of the intestine in the history of the clinic was handled." Therefore, when a patient presents himself with the symptoms already mentioned, one must necessarily bear in mind this alarming increase. A report from the Metropolitan Life Insurance Company states that cancer in general is increasing at the rate of 15 per cent per year. During the month of January, I operated on 8 patients with carcinoma of the colon. On the other hand cancer of the stomach appears correspondingly less in the picture.

Read before the Greater Boston Medical Society, March 9, 1937.

From the surgical services the Jewish and Mount Sinai hospitals Philadelphia, Pa.



Fig 1 Carcinoma of the splenic flexure. Undiagnosed until operation was performed. Treated medically 18 months for chronic intestinal obstruction.

In the Lucien Moss Home of the Jewish Hospital where incurables are admitted many patients have been treated in whom the true diagnosis of cancer was never made. Of the 130 patients admitted to the active services of the Jewish Hospital we were compelled to discharge 50 as inoperable. The latter do not appear in any graphs. Autopsy of medical cases disclosed numerous cases of cancer which had remained unsuspected or undiagnosed.

According to a personal communication from Dr. Harry Bacon of the Philadelphia General Hospital, of 510 patients admitted, 49.1 per cent were inoperable as a result of fixation of the growth, involvement of adjacent structures, palpable liver metastasis, x-ray examination, or exploratory laparotomy. Naturally more patients with inoperable conditions would be admitted to this type of hospital as it receives mostly the poor and underprivileged common to county hospitals.

In the Mount Sinai Hospital 78 patients were admitted in the past 10 years. These also illus-

TABLE I—ANATOMICAL DISTRIBUTION IN 158 CASES OF CARCINOMA OF THE COLON

	Cases
Cecum	14
Ascending colon	4
Hepatic flexure	3
Transverse colon	9
Splenic flexure	6
Descending colon	7
Sigmoid	3
Rectosigmoid	16
Rectum	60
Anorectal junction	1
Ascending colon and rectosigmoid junction (multiple)	1

TABLE II—AGE AND SEX INCIDENCE

Ages in Years	Cases
20 to 30	3
30 to 40	15
40 to 50	35
50 to 60	55
60 to 70	32
70 to 80	18
Sex	
Male	81
Female	77

trate the all too frequent failure to diagnose tumors of the colon. It has been my experience that lesions in the colon are fairly equally well distributed, with the great majority in the recto-sigmoid and rectal region (Table I).

AGE INCIDENCE AND SEX

In carcinoma of the colon, as in cancer in other parts of the body, the younger the individual affected the more malignant is the lesion (Table II). Ross states that cancer of the rectum is not strictly a disease of old age. In 2 to 4 per cent of cases it occurs before the thirteenth year. Larson and Nordland's age range was from 14 to 84 years of age. The youngest patient I ever operated upon was a girl of 23. Cancer affected the transverse colon. She died from general carcinomatosis about 8 months following the primary operation. A robust man of 29 years, with carcinoma of the rectum was apparently well for 8 months following a two stage operation when he died of metastasis to other organs (Fig. 2). The oldest patient was 72 years of age. He had a large mass in the region of the sigmoid (Fig. 3). After a modified Mickulicz operation he left the hospital in about 6 weeks, with a pin point opening of the wound.

Generally speaking, males are more prone to cancer of the colon and rectum than females. In our combined group of 158 cases there were 81 males and 77 females (Table II).

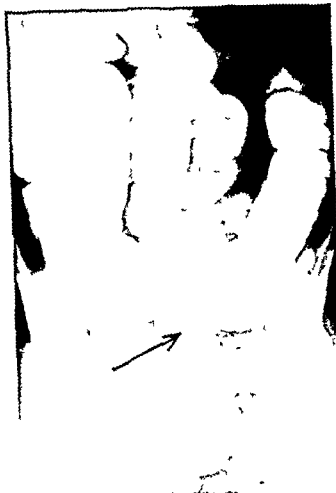


FIG. 2 Carcinoma of rectum in a robust man of 79 years. Died from metastasis 8 months following operation.



FIG. 3 Carcinoma of sigmoid in a man 72 years of age. Patient enjoying very good health.

F. S. Railford in a study of 511 cases of cancer of the colon and rectum found that male patients outnumbered female patients two to one, while Larson and Nordland in a review of 210 cases found an equal frequency in males and females. In Heydemann's group of 346, 63 per cent were males and 37 per cent were females.

METHODS OF DIAGNOSIS

Any individual past 35 years, with indefinite abdominal symptoms present, should have a digital and sigmoidoscopic examination of the rectum and a barium enema for determination by x-ray whether a lesion is present.

A digital examination is advised because most cases of carcinoma reported have been situated in the rectum from 4 to 6 inches above the anus. The patient should be placed in various positions for the examination, namely, in the dorsal, the lateral, flat on the abdomen, and the knee chest position. From experience it has been shown that a lesion which cannot be felt in one position may nevertheless be found in another. The sig-

moidoscope is of great help for lesions situated above the reach of the examining finger. This examination is also important in detecting polyps in those patients in whom these tumors precede carcinoma. However, I have not observed great frequency of polyps as precursors of cancer of the colon. Most of my patients had advanced types with ulceration of the mucous membrane and destruction of the predisposing polyp. Nevertheless most surgeons believe that adenomatous polyps predispose to cancer of the colon. Felsen and Wells collected statistics from Doering, Hullsieck, Yeomans, Susman, and Westlus. The incidence of polyposis ranged from 34 to 100 per cent. It is not wise, if nothing is found by a digital examination, to depend on that fact alone to make a negative diagnosis, especially with a continuation of symptoms, one negative report from the radiologist should not preclude the thought of a possible cancer. An examination at various intervals is necessary to determine the cause of symptoms, for the lesion may not have progressed sufficiently to register the barium enema



Fig. 4 A case of pseudomyxoma peritonei of the cecum. Sometimes physical signs resemble carcinoma.

Symptoms in the first stages of carcinoma of the colon may simulate various conditions found in the abdomen, thus rendering the early diagnosis

an exceedingly difficult one. Yet early diagnosis is most important in cancer of the colon as in this way only can the greatest number receive the greatest good at the hands of the surgeon. In the later stages when the tumor is felt, and the diagnosis is easily made, it is too late for the surgeon to be helpful. Curiously enough even at this stage of the disease there are many failures in its recognition. A tumor or tumefaction may be present without being palpable through the abdominal wall, naturally an unfortunate situation, since even at this time the patient may feel and look well. When a tumor is felt in the various divisions of the colon, a differential diagnosis between similar lesions of other organs in the same neighborhood must be made. Most of the mistakes in such diagnoses occur when a mass is felt in the right iliac fossa. To illustrate, a patient was admitted who presented, in the films, a typical defect characteristic of cancer of the cecum. The microscopic report showed this to be pseudomyxoma peritonei associated with a malignant carcinoid tumor of the appendix (Figs. 4, 5 and 6). The patient is now in perfect health, having gained 40 pounds in weight since operation. Again a lesion in the splenic flexure may be mistaken for a tumor of the spleen or kidney. However, with blood studies and a consideration of the general outline and contour of the spleen, one should be able to differentiate between these two conditions. Recently a patient came under observation in whom we could not demonstrate by means of physical examination the exact location of the lesion. At operation we found a retroperitoneal sarcoma. Lesions in the descending colon are usually of a small constrictive type and



Fig. 5 Pseudomyxoma peritonei as seen under the microscope.

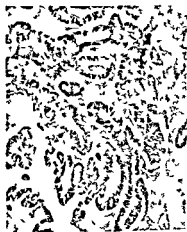


Fig. 6 For comparison a true case of carcinoma of the colon.

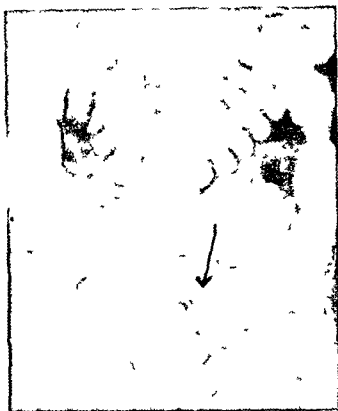


Fig 7. Carcinoma of the rectosigmoid, usually a tumor of considerable size

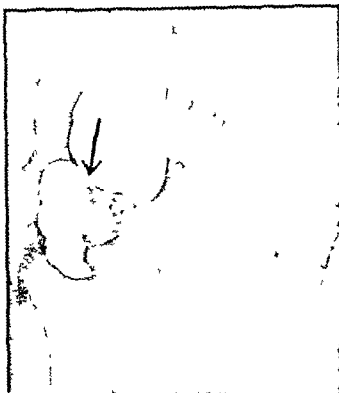


Fig 8. Carcinoma of ascending colon. Patient 58 years old treated for pernicious anemia. Admitted to hospital with hemoglobin of 30

give rise to symptoms of chronic intestinal obstruction. It is, therefore, very difficult to palpate a tumor in this region. Such a type of tumor may continue for years without giving any signs of cachexia. Cancer of the rectosigmoid (Fig 7) usually involves a tumor of considerable size and takes some time to develop. On account of the continual traumatism the mucous membrane is generally ulcerated. Peritoneal inflammation of the gut is often present. Diverticulitis usually occurs on the left side and is often mistaken for carcinoma found in the left half of the colon. Operation reveals the true nature of the disease which requires usually incision and drainage. Ulceration is a very common occurrence in carcinoma of the rectum during the late stages, giving rise to mucus, blood, and foul discharge. This, so often the first definite sign, must constitute a warning to the patient and physician alike, as to the nature of his condition. In a few cases, carcinoma of the ulcerative type occurs an inch or 2 above the anus and may involve the anus itself. Such cases are usually brought to our attention early because of the irritation and discomfort suffered by the patient. How often in patients with carcinoma of the gastro intestinal tract a diagnosis of pernicious anemia is made! I can cite many examples of this flagrant mistake. One will



Fig 9. A case of multiple carcinoma of the colon affecting ascending colon and rectosigmoid junction



Fig 10 Cross specimen closed Carcinoma of ascend ing, colon and cecum

suffice A patient 58 years old had been treated by a proctologist for one year for bleeding from the bowel (Fig 8) Upon admission to the hospital, his hemoglobin was 30 After numerous transfusions a resection in two stages was performed The patient lived 2 years during which time he was able to follow his former occupation Karsner Clark and Rankin point out the fact that anemia is more severe in carcinoma of the right half of the colon than in cancer of the left half

SIMULTANEOUS MULTIPLE LESIONS

The presence of simultaneous multiple carcinomas of the colon is not a common condition The symptoms are the same as those found in a single lesion The diagnosis is usually made with the x ray I have had one patient in whom there was found cancer of the ascending colon and of the rectosigmoid junction (Fig 9) A complete colectomy in stages was performed

Simultaneous cancer of the stomach and ascending colon was found in another patient The disease in the stomach for which a resection was performed was far advanced The lesion in the colon may have been a primary or secondary one



Fig 11 Same specimen as shown in Figure 10—opened

This could never be proved The patient did well after the operation However, soon after deep x ray therapy was begun for the colon cancer, the patient reacted badly and died about 5 months after the original operation Warren and Gates collected 1,872 cases of multiple carcinoma of the colon In one group the incidence was 1 per cent in another 6 per cent of the total number of cases of multiple carcinoma in all parts of the body A J Cokkins reports 4 original cases of multiple carcinomas of the colon He observes that one should always look for multiple growths in all operations for cancer of the intestine Bagen and Rankin have seen 16 cases In reporting 2 cases of multiple cancer of the colon, Thompson states that before multiple carcinomas can be classified as separate and distinct lesions, Billroth's postulates must be considered, namely, that (1) the 2 growths must show distinct histological differences which must be so pronounced as to exclude the possibility that they are of the same origin but in different stages of development (2) that each growth must spring from its parent epithelium (3) that each growth must be held responsible for its own group of metastatic growths

ILEITIS AND CARCINOMA OF THE COLON

Ileitis has recently become according to some, a rather common affection It must be considered, therefore, in a differential diagnosis from carcinoma whenever ileitis attacks the ileum and a portion of the cecum X ray examinations will here be of great assistance Physical examinations will not help much if a large tumefaction is

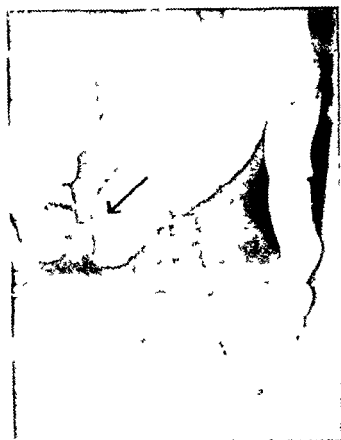


Fig. 12 Carcinoma of the transverse colon in an obese Italian woman

present. Some similarity to cancer exists in the symptoms, such as blood and mucus in the stools, with intermittent diarrhea. There is usually, however, a leucocytosis in ileitis which is absent in carcinoma of the colon except in cases in which perforation and inflammatory reaction have occurred around the cancer. Strange to relate, in an active surgical experience of nearly 30 years, I have never operated upon a patient with ileitis.

OBESITY AND CANCER OF THE COLON

Formerly all cancer cases were associated with emaciation. That cancer of the colon occurs in well nourished individuals, often in the prime of life, when least suspected, has been frequently observed. Obesity is no guarantee against carcinoma at any time, in any part of the body. This is especially true of carcinoma of the gastrointestinal tract which claims victims frequently weighing around 200 pounds. Within the past 2 months, I have had the experience of operating upon 3 such patients, 1 man and 2 women, who apparently were in the pink of health. They were well nourished, had ruddy cheeks, and the youngest was a man of 40, whose case remained undiagnosed for a year because his physicians, with the



Fig. 13 Specimen illustrating x ray of Figure 12

exception of the last consultant, did not believe that he could harbor a malignant growth (Figs 10, 11). A cancer of the cecum and ascending colon was found. Of the women, one, an obese Italian, on whom I had operated 12 years before for acute suppurative appendicitis, had a cancer located in the transverse colon (Figs 12, 13, 14). The third patient gave a history of a hemorrhage 8 years ago. This did not give her much concern. The bleeding recurred recently, however, when she sought medical advice. X ray examination



Fig. 14 Closeup of specimen shown in Figure 13



Fig. 15. Patient had numerous hemorrhages. Specimen shows marked thickening of wall of cecum.

showed a lesion in the cecum (Figs. 15, 16). Judging from external appearances no one would have considered a malignant lesion as a probability. A partial colectomy was performed in all these patients with good recovery.

IRRADIATION OF CANCER OF THE COLON

In the consideration of pre-operative and post-operative treatment of cancer of the colon, it is fitting that the subject of irradiation receive due consideration. In my experience irradiation by means of the x-ray or radium has never influenced the progress of the disease so far as the beneficial results of these agents are concerned, although Binkley believes that tumors of the lower part of the rectal and anal wall respond well to x-ray and radium. Railford in an excellent dissertation on carcinoma of the colon concludes that irradiation may relieve symptoms and prolong life in the hopeless case. It has been my thought for many years that the powerful dosage of x-ray upon gastro-intestinal carcinoma has done more harm than good by metastasis to other organs. In addition to its questionable effects, deep x-ray therapy has a devitalizing effect upon the blood. It necessitates many transfusions while this form of treatment is being used. After operation if one is not absolutely sure of the entire removal of the growth and the involved glands, deep x-ray therapy should be used for a limited time only. A thorough operation with removal of the entire lesion leaves little need for deep x-ray therapy. Operation then holds out the best prognosis for the patient suffering from cancer of the colon.

PRE-OPERATIVE TREATMENT

Pre-operative and postoperative treatment of patients suffering from carcinoma of the colon has changed very radically in the past few years.



Fig. 16. Same specimen as shown in Figure 15—opened and showing much thickened wall of cecum.

This fact has contributed much to our lowered mortality, and a generally improved convalescence of these patients. Before operation it is essential that the intestinal tract should be thoroughly cleansed with castor oil followed by one or two daily colonic irrigations, and the infusion of 500 to 1000 cubic centimeters of 10 per cent glucose by venoclysis. The diet for at least 2 or 3 days should be sweetened liquids, no milk. Empirically I digitalize all of these patients. It has not done any harm, while it may do good. If more than a one-stage operation is required the patient must go through exactly this same routine.

IMMUNIZATION OF THE PATIENT

I still have an open mind on the use of perfringens vaccine given intraperitoneally or intramuscularly, or the vaccine of killed streptococcus, staphylococcus, and colon bacillus, administered intraperitoneally at least 48 hours before operation. It may be beneficial also after operation, and be repeated before and after each stage. The

procedure has given rise to a difference of opinion concerning the efficacy of vaccine before and after operations on the colon. For many years I did not use them. My recent resort to them has given no appreciable difference in the number of infections. In conversation with Dr. L. W. Smith, professor of pathology, Temple University, it was set forth that in order to immunize these patients the vaccine must be given at least 10 days before operation. Accordingly much of our treatment by immunization is superfluous. There is still a wide difference of opinion concerning the efficacy of the use of vaccines in the prevention of infection. Those at the Mayo Clinic are certain that vaccines are efficient, while Cattell never uses them. Rankin now believes that they do no good. Wilkie attempts immunization 8 and 3 days before operation. To induce leucocytosis he injects, the night before operation, 5 cubic centimeters of 5 per cent solution of sodium nucleinate.

After operation we use continuous hypodermoclysis, and if necessary as many blood transfusions as are indicated are given before and after operation. In those cases, for instance, in which a mistaken diagnosis of anemia has been made, when the hemoglobin is around 30, it is obvious that several transfusions must be given before operation. After operation there is no question that blood transfusions act as a great tonic to these patients.

ANESTHESIA

Spinal anesthesia is the best anesthetic, in my experience, in the performance of operations on the colon. If the operation is performed in different stages, no matter how many, spinal anesthesia is always my choice. Here, as in other abdominal conditions, especially those in the upper abdomen, spinal anesthesia has saved many lives. Operations on the colon can be done in an almost aseptic manner due to the perfect relaxation one obtains by this form of block anesthesia. There is, then, less danger of spreading infection because of the surgeon's perfect control of the intestinal tract. Furthermore, this form of anesthesia is as safe as any other we have used. In somewhat over 300 cases I have never had a death following the use of neocaine.

OPERATION

Much has been learned in the past few years concerning the various types of operation that should be performed, depending on the location of the lesion. With the added experience gained from a great increase in the number of cases of

carcinoma of the colon, I have become an advocate of the 2 stage operation in most cases of carcinoma of the colon. I believe that more lives will be saved by the 2 stage operation than by the operation in one stage. This applies especially to those patients in whom considerable inflammation has occurred around the tumor. The performance of a preliminary colostomy preceding the operation for removal of the growth by allowing the inflammation around the tumor to subside demonstrates the soundness of this advice. A more perfect operation with less danger of infection is thus made possible.

There is no question that whenever and wherever the Mickulicz operation can be performed, it is unquestionably the safest to do. In this modification the tumor is excised between clamps at the first operation. For carcinoma in the region of the cecum, two methods can be employed. A portion of the ileum, cecum, and ascending colon may be excised and presented in the wound as a double barrelled ileostomy and colostomy. Another method and one which is preferable because it eliminates a colostomy is, first, to perform an ileotransversecolostomy with closure of the abdomen, the ileum and the colon including the growth being removed later. The ends of the ileum and colon are closed. This operation may also be performed in one stage, with an added Pezzer ileostomy as a protection against distention. The ideal operation in the constrictive type of carcinoma of the colon is a preliminary colostomy with resection of the tumor and an end-to-end anastomosis. These constrictive types, as stated before, are usually found in the ascending and descending colons. A tumor at the rectosigmoid junction or rectum is probably best treated by the Lahey or Rankin type of operation, the two stage operation that has been very helpful in the solution of this problem. Occasionally when cancer attacks the rectosigmoid junction and is operated upon by a modified Mickulicz operation, the tumor with the colon must first be mobilized. Carcinoma near the anus can be excised. The rectum is mobilized and a new anus is made by suturing the rectum to the skin, without a preliminary colostomy. Stricture of the new anus is prevented by the use of rectal bougies. Electrocoagulation of the ulcer can also be employed. The results following this procedure have justified the method.

INFECTION

Infection by the colon bacillus seems to be the *bête noire* of operations upon the large bowel. Infection ranges from a slight stitch abscess to a massive peritonitis. The aphorism of the late

John B. Deaver is applicable to this type of intestinal surgery. "Cut well, sew well, get well." Yet even after adherence to all these principles infection occurs all too frequently. It always happens after the final operation, namely the closure of the colostomy and the second stage of any of the many types of operation employed. With all the refinements of anastomosis by occlusion, or the so called aseptic type of anastomosis infection of a mild to a serious degree complicates the course of every patient operated upon.

Late infection in the region of the loin space has occurred in a fair percentage of cases. As a result of this I now, at the time of operation, make an incision for drainage lateral to the wound and drain with tube or gauze and rubber at this point. The pelvis is also drained, following the second stage operations on the sigmoid and rectum.

MORTALITY

The mortality following operations on the colon in former years was appalling. It ranged between 30 and 40 per cent. On account of our selective type of operation and better technique this has been greatly reduced. At present the mortality is about 10 per cent. F. Mandl, in review of 135 operations states that after radical sacral methods they have had a mortality a little less than 10 per cent. Heydemann states 23.7 per cent died after the radical operation. The greatest danger naturally arises from peritonitis because of the ever present colon bacillus in the large intestine. It is impossible to sterilize the colon. In contradistinction the small intestine can be operated upon freely and one might say carelessly without a semblance of any infection following operation. From both hospitals, we can record a number of 5 and 7 year cures, but most of the

patients on whom we operated have had recurrences within 3 years.

CONCLUSIONS

1. In all symptoms referable to the gastrointestinal tract it behooves us then to be suspicious of carcinoma of the colon. Early diagnosis is of paramount importance.

2. Mistaking carcinoma of the colon for pernicious anemia is a tragic and unpardonable mistake.

3. Pre-operative preparation and post-operative care are important factors in reducing the immediate mortality.

4. Operations for carcinoma of the colon are selective depending upon the location of the lesion.

BIBLIOGRAPHY

1. BINKLEY G. E. J. Am. M. A. S. 1932 90 139
2. CATTELL, R. B. J. Am. M. A. S. 1936 10, 2011
3. COCKINS A. J. Brit. J. Surg. 1934, 21 5, a.
4. CRAPOORD C. Acta chirurg. Scand. 1934, 74 513
5. DIXON C. F. Proceed. Staff Meet. Mayo Clin 1934 11 No. 40
6. FELSEN J., and WELLS JOSEPH J. J. Am. M. A. S. 1934 102 683
7. HEYDEMANN E. R. Beitr. z. Klin. Chir. 1933 13 173
8. KARSNER H. T., and CLARK B. JR. Am. J. Cancer 1932 16 933
9. LARSON L. M. and NORDLAND M. Ann Surg. 1934, 100 328
10. MANDL F. Zentralbl. f. Chir. 1934, p. 7946
11. Metropolitan Life Insurance Co. 1932 Oct.
12. PETTIGARY V. Clin. Lab. 1932 1, 281
13. RAILFORD T. S. Ann Surg. 1935 101 863
14. RANKIN F. W. J. Am. M. A. S. 1936 10, 2015
15. RANKIN F. W. and BARGEN J. A. Arch. Surg., 1931 22 68
16. ROSS L. I. Am. J. Cancer 1934 21 322
17. THOMPSON J. W. J. Am. M. A. S. 1936 10, 1600
18. WEBER H. M. Am. J. Cancer 1935 17 31

ACCIDENTS IN RENAL SURGERY

ALBERT E. GOLDSTEIN, M D, F A C S, Baltimore, Maryland

ACCIDENTS in renal surgery, whether slight or extensive, avoidable or unavoidable, always give the surgeon great concern. In reviewing the literature one is impressed with the scarcity of reports. Undoubtedly there are many such accidents, but reports of them fail to reach the literature.

An analysis has been made of all the surgical renal cases, exclusive of those affecting the ureter, in which operation has been done at the Sinai Hospital during the past 15 years. It has been found that during this period, on the urological service, 345 operations have been performed on the kidney, and that there were 43 accidents, 12.5 per cent, in 40 patients.

The accidents are listed in Table I.

The types of operation being performed when accidental occurred are given in Table II.

For the purpose of discussion the accidents are divided into the four following groups:

I. Accidents in the approach to the kidney.

II. Accidents to the blood vessels and kidney.

III. Accidents to the closely approximated or distant structures during the operation.

IV. Accidents immediately after operation.

In group I the following accidents may occur: (1) the iliohypogastric or first lumbar nerve may be severed, (2) the peritoneal cavity may be opened, (3) there may be hemorrhage, (4) a rib may be fractured, (5) there may ensue temporary paralysis of an arm.

While some few accidents have occurred and can occur very readily in the approach to the kidney, they do not comprise the largest or the most serious group. We have encountered 11 accidents in this group which were caused principally by having insufficient operating space, poor exposure, improper position of the patient, or too much traction. Special care should be taken in placing the patient on the operating table, particular attention being paid to the amount of pressure on the resting arm.

While no serious damage results from cutting a nerve, it is well to locate the nerve and retract it to avoid any unnecessary anesthesia or hyperesthesia following recovery. Transfixion sutures should be employed readily in cutting the

costovertebral ligament, otherwise troublesome bleeding occurs which delays the operation. In an effort to obtain sufficient exposure, care must be taken not to have too much traction against the ribs as a fracture may result, as in one of our cases. Unless the peritoneum is gently stripped away from the kidney and kept well ahead of the incision in the muscles there is danger of opening it.

In group II—accidents affecting the blood vessels and kidney—there may be accidental hemorrhage from any of the following vessels: retroperitoneal vessel, aberrant renal vessels, main renal vessels, inferior vena cava, abdominal aorta, and adrenal vessel. The possible accidents to the kidney or adrenal gland are hemorrhage from kidney substance, hemorrhage from adrenal substance, and ligation of an aberrant renal vessel.

Many more accidents occur in the manipulation of the organ than in its approach. Unrecognized aberrant vessels undoubtedly play a great rôle in the production of accidents. An unusual amount of handling the kidney as well as the freeing of adhesions in its delivery frequently results in a severe hemorrhage from a torn aberrant vessel (11.6 per cent). In 1 of our cases a fatal hemorrhage resulted.

The greatest number of accidents occur on the right side especially if the nephrectomy is difficult.

Injury to the vena cava rarely occurs on the left because of the great length of the renal vein.

By far the greatest number and more serious accidents occur in the application or following the application of clamps to the pedicle. It is very noticeable from reports that hemorrhage from tears in vessels, principally the vena cava and renal vessels, give the greatest concern to the surgeon. The accidents in most instances follow the removal of the kidney. Either a clamp slips, a ligature loosens, a vessel retracts, or a hole is torn in a vessel. These accidents are always followed by severe hemorrhage resulting frequently in immediate death.

According to reports, the accidental hemorrhage appears more frequently from tears in the inferior vena cava (Chute, Petit, Guerry, Cabot, Phillips, Rathbun, and Walters) than it does from the renal vessels. This is quite contrary to our experience, in our series we had 19 cases of

From the Department of Genito Urinary Surgery, Sinai Hospital.
Read before Genito Urinary Section, New York Academy of Medicine, December 18, 1935.

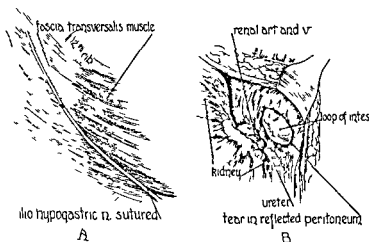


Fig 1 The iliohypogastric nerve sutured after the nerve had been cut. This accident occurred in 3 of our cases. A tear in the reflected peritoneum is also shown. This accident occurred in 4 of our cases.

accidental hemorrhage, none of which was from the vena cava.

In any case the accident is a serious one, yet some very excellent results have been reported following the repair. In 4 cases of tear in the inferior vena cava Chute sutured with black silk. 2 patients died and 2 recovered. Petit reports on 19 cases in which lateral suturing of the tear was done, and 17 recovered. Cabot had recovery in 2 cases. 1 of which was sutured but clamps were left on the tear for 7 days. Guerry did not employ

sutures but left forceps on the tear in 3 cases and all recovered. Walters reports 4 cases in which the inferior vena cava was opened, 2 intentionally. Sutures were used in all cases and all recovered.

Other sources of hemorrhage following accidents in renal surgery are injuries to the adrenal vessels or gland, also to the retroperic artery and kidney proper. In the removal of a very adherent kidney with pyelonephritis in which the fatty capsule cannot be separated, a serious hemorrhage may follow. Hyman reports a case in which the adrenal gland was unintentionally removed with the kidney. Death followed. In 1 of our cases a profuse hemorrhage which followed the delivery of the kidney but was not coming from the renal pedicle was seen spurting from one of the adrenal vessels, which was ligated and the hemorrhage ceased. On examination of the removed kidney, half of the adrenal gland was found (Case 16).

Pyelotomy for renal calculus especially in cases in which the pelvis is intrarenal, frequently results in cutting the retroperic artery causing hemorrhage that at times cannot be controlled. In 2 of our cases perfect kidneys were sacrificed in order to save life (Cases 7 and 27).

Accidental incisions into the kidney substance or tearing a portion of the cortex of the kidney may result in hemorrhage that cannot be controlled by the usual methods and in order to save life, a nephrectomy is necessary. This accident occurred in our series in 4 cases (Cases 11, 13, 15, and 24).

Aberrant vessels frequently supply a large portion of a kidney so that judgment must be exercised before ligating one, otherwise the kidney

TABLE I—ACCIDENTS RECORDED

Hemorrhage	Cases
a Main renal—immediate	5
b Main renal—late	4
c Retroperic vessels	2
d Aberrant vessels	5
e Suprarenal vessels	1
f Kidney proper	4
Total	21
Congrene from thrombosis	2
Diaphragmatic tear	2
Pleural tear	1
Lung puncture	1
Fistulas	2
Duodenal rupture	1
Peritoneum opened	4
Fractured rib	1
Ligation of aberrant vessel—unintentional	1
Evulsion of ureter	1
Severing nerve (iliohypogastric or lumbar)	3
Temporary paralysis of arm	2
Loss of broken needle	1
Total	43

No case of injury to the inferior vena cava abdominal aorta large bowel liver spleen or pancreas was encountered

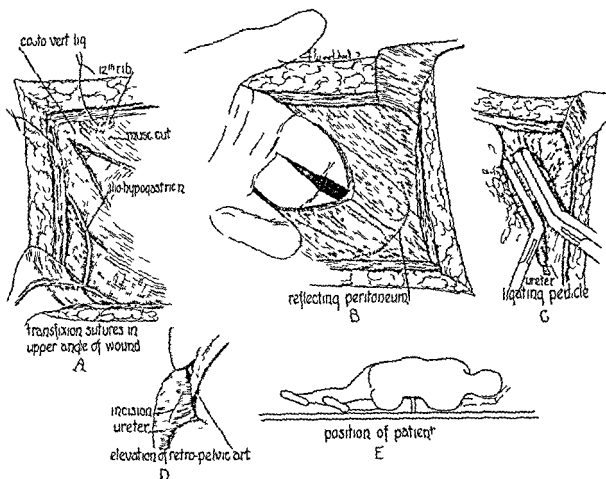


Fig 2 This drawing shows the best position for the patient, the position of the iliohypogastric nerve with the muscle being pulled aside, the method of placing the sutures in the upper angle of the wound to check bleeding of keeping the peritoneum well ahead of the incision in the muscles and of elevating the retro-pelvic artery

may lose its principal blood supply. An accidental ligation occurred in Case 10 but a subsequent follow up revealed no disorder to the kidney.

In group III—accidents that may occur to the closely approximated or distant structures—may be found the following: (1) opening of peritoneum, (2) injury to duodenum or small intestine, (3) injury to large intestine, (4) injury to diaphragm, (5) injury to pleura, (6) injury to lung, (7) injury to pancreas, (8) injury to spleen.

Again the undue handling or difficult delivery of the kidney frequently causes injury to the peritoneum (Mathé), diaphragm and pleura (Rathbun, Quinby, and Mathé). In 4 of our cases the peritoneum was accidentally opened with no serious results (Cases 32, 33, 34, 35). In 2 of our cases the diaphragm was injured (Cases 6 and 8) while in 1 the pleura was torn (Case 6). All recovered. It is more difficult to have an injury to the pleura on the right than on the left side (Fig 4).

Other serious accidents that may and do occur in the application of pedicle clamps are injury

to the duodenum, small bowel, large bowel, and pancreas. Injuries to the duodenum appear to be more prevalent. Accidents to the duodenum in this manner have been reported by Rathbun, Felber, and Mayo. Young and Colston report

TABLE II—TYPES OF OPERATION

Operation	Cases
Nephrectomy	
a Tuberculosis	3
b Neoplasm	2
c Pyogenic pyonephrosis	8
d Calculous pyonephrosis	7
e Pyelonephritis	2
f Hydronephrosis	6
Total nephrectomies	65 per cent 28
Pyelotomy—calculus	3
Nephrotomy—calculus or drainage	4
Nephropexy—renal ptosis	3
Incision and drainage—perinephritic abscess	2
Ligation of vessel—hydronephrosis	1
Plastic—hydronephrosis	1
Decapsulation—nephritis	1
Total	43

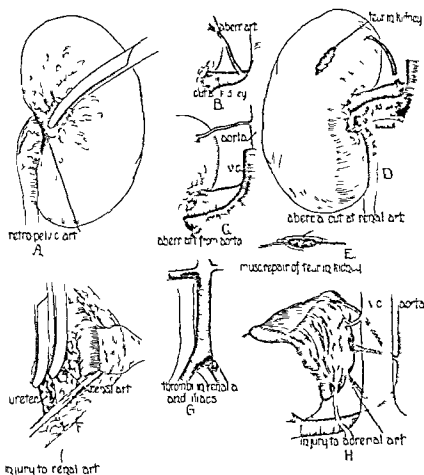


Fig 3 The vessels that have caused accidental hemorrhage in 21 of our cases. The drawing shows how easily bleeding can occur from a retroperitoneal artery from an aberrant artery from the renal artery which was accidentally cut close to the kidney, how hemorrhage may follow injury to an aberrant artery coming from the aorta which was not caught in the pedicle clamps to an aberrant artery coming from the renal artery and cut close to the renal artery, how hemorrhage may result from an accidental tear in the kidney, from an injury to the renal artery in placing the pedicle clamps from injury to the adrenal artery. Muscle repair of a tear in the kidney and the thrombosis in renal and iliac arteries are also demonstrated. This latter accident occurred in 2 of our cases.

accidents to the pancreas. We have had one accident to the duodenum in our series but none to the other structures (Fig 5). In our case (Case 9) it did not follow the application of a clamp but the accidental introduction of the finger into an ulcerated portion of the uncovered duodenum in a case of perinephritic abscess.

Whipple in the removal of a left kidney, encountered injury to the descending colon which was ulcerated and attached to the left kidney.

Complete tearing away of the ureter from a kidney as reported by Cowden is not a common accident. Unfortunately it happened in one of

our cases (Case 21). Since a profuse hemorrhage also existed it was considered advisable by the surgeon to do a nephrectomy (Fig 6).

In group IV—accidents that may occur immediately after operation—are included (1) immediate accidents, such as hemorrhage from pedicle because of loosening of ligature or clamp and (2) late accidents such as (a) hemorrhage, (b) thrombi and emboli, (c) temporary paralysis of upper extremity, and (d) fistulas.

In group IV damage is observed after the accident has occurred, probably it was not or could not have been noticed in the beginning. Per

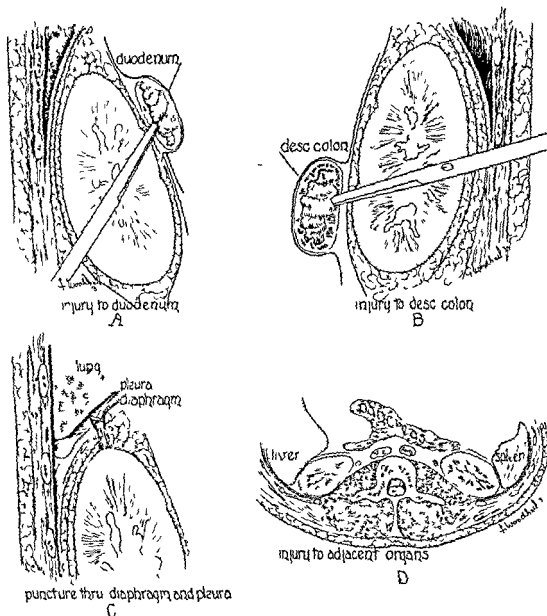


Fig 4 Here is shown an injury to the duodenum from pedicle clamps, a type which we have not encountered, also injury to the pleura, diaphragm and lung which we have encountered in 4 cases, injury to the descending colon, which we have not encountered in our series. The cross section showing the relationship of the kidney to the other organs, demonstrates that it is possible to have accidents to the other organs

mitting a patient to return to his bed while still oozing blood is a dangerous procedure, yet one is forced to do this in some instances on account of the presence of shock. If at all possible undue hemorrhage should be checked. Occasionally there will be delayed profuse bleeding as in 4 cases of our series (Cases 4, 5, 28, and 39). Three recovered because the condition was discovered early and quick action was taken—the wound was quickly packed. One patient (Case 4) died because of the fact that no effort was made to check hemorrhage.

Pedicle clamps should be placed as close to the kidney as possible so that when the kidney is re-

moved, there will be ample room for the pedicle to retract, thus making ligation simpler. There is less chance in this manner for ligatures to slip after the patient has returned to bed. In addition, the longer the stump of the pedicle the less chance for a blood clot, which may be infected, to become thrombotic and cause obstruction in one of the larger vessels. In 2 of our infected cases (Cases 14 and 19) the pedicle was tied close to the abdominal aorta and the inferior vena cava, causing thrombosis of the iliacs which resulted in lower extremity gangrene and death (Fig 3,G).

Particular care must be taken to remove all foreign bodies, particularly in cases of hemor-

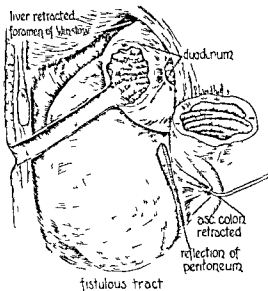


Fig. 3 An injury to the duodenum producing a fistulous tract in one of our cases

rhage otherwise a fistulous tract will result (Cases 15 and 20)

PROCEDURES WHEN ACCIDENTS OCCUR

Experience teaches new and better methods. When an accident occurs, it is of utmost importance to act quickly and calmly.

Hemorrhage occurring in the approach to the kidney can usually be controlled very easily. A very troublesome place is in the upper angle of the wound where the costovertebral ligament is

cut. This is best controlled by transfixion sutures through the tissue on each side (Fig. 2, A).

Should a hemorrhage occur from the main renal vessels or from a large aberrant vessel prior to the removal of the kidney, in a case in which nephrectomy is contemplated, we have found that the best and safest procedure is to remove the kidney quickly, as a better opportunity will thus be presented for locating the bleeding point. Should the hemorrhage occur after the kidney has been removed, it is best not to grasp at anything but to manipulate with the thumb and index finger of one hand to obtain pulsation if possible or to grasp the bleeder between the fingers and then place the pedicle clamps. Another procedure we have carried out frequently is to pack the wound and make pressure. This is sufficient in many instances, while in others the gradual and gentle removal of the pack will permit one to locate the bleeding point. We have never had the occasion to do any repairing to a large vessel as we have never encountered bleeding from the vena cava or the abdominal aorta (Fig. 3, F).

If bleeding occurs from an aberrant vessel which arises from the renal but close to the origin of the renal, it frequently is difficult to ligate, so that it may be necessary to remove a kidney to check the bleeding. When the bleeding arises from an aberrant vessel and the bleeding point is in the kidney, it may be necessary to ligate the vessel or to place muscle or make pressure to check the bleeding (Fig. 3, B, D, E).

Hemorrhage from an accidental surgical tear in the kidney requires careful attention. One of the procedures of applying pressure, suturing the

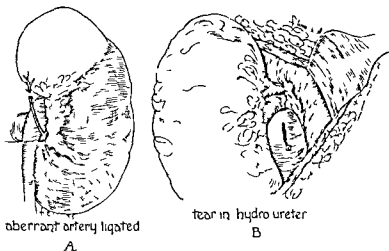


Fig. 6 A tear in the hydro ureter also accidental ligation of an aberrant artery caused an infarct. One of each occurred in our series.

capsule, insertion of muscle or tying with catgut strips is employed before a kidney is sacrificed (Fig 3,D,E)

When the hemorrhage occurs from a retroperitoneal artery a ligature at both ends is best, but we have had to sacrifice a good kidney in 2 instances (Cases 7 and 27) when this procedure was of no avail and in order to save life we were compelled to carry out heroic measures by removing the kidney (Fig 3,A)

Hemorrhage from the suprarenal gland or artery is very troublesome and can be checked by ligating the vessel only if sufficient exposure is obtained. It may at times be necessary to remove the gland (Case 16, Fig 3,H)

Injury to the diaphragm and pleura should be recognized immediately by the hissing noise and should be sutured immediately if possible. Should it occur before the kidney is removed, as it did in our cases, closure should be made if possible. If not it is best to pack it off and remove the organ and then attend to the tear. The question of drainage is important. In our case of pleura tear (Case 6) it was impossible to suture so we drained the area and the patient made an uneventful recovery. A tear in the presence of a pyogenic infection should be closed if possible and the renal bed drained (Fig 4,C)

Tears into the peritoneal cavity, if recognized, are best attended to immediately by closing the opening tightly and not draining, but the renal bed should be drained (Fig 1,B)

Injury or hemorrhage from an organ, such as the liver, pancreas, or spleen, has never occurred in our series. Should such an accident occur, suturing around the tear with a tube for drainage to the site of injury would probably control the situation as well as any other procedure (Fig 4,D)

Injury to the small or large bowel should be controlled immediately if possible. Closure of the rent is of utmost importance. Drainage should be instituted but only in the renal bed (Fig 4,A,B)

Severing a large nerve during the course of the operation is not a serious problem. If the ends can be brought together easily with one black silk suture it is best to do so. If such suture is not possible, no serious results occur as frequently the nerve ends find each other. Results of this accident may be anesthesia or hyperesthesia around the hip, which usually is only a temporary affair (Fig 1,A)

Temporarily placing a rubber covered clamp on a pedicle so that a clear field can be obtained while working on the kidney is the usual procedure in our clinic. Care must be taken not to permit the clamp to remain on too long. We have left

clamps on as long as 30 minutes at one time without any serious damage, but care should be taken not to obliterate the lumen of the vessels completely in clamping. Our usual procedure in cases of this kind is to release the clamp after 10 minutes and then reapply it.

In clamping aberrant vessels for treatment of obstruction at the uteropelvic juncture, it is important to observe, before cutting, the amount of kidney tissue the vessel supplies. This can readily be determined by observing the change in color. We ligated one such vessel going to the upper pole and cut before making the observation (Case 10). Fortunately, it supplied only a portion of the upper pole of the kidney. A definite line of demarcation was observed but the patient made an uneventful recovery (Fig 6,A)

CASE REPORTS

Abstracts of some of the cases in our clinic will be printed in the reprints of this article. In the series of cases there were in all 43 accidents, 3 patients having had two accidents each.

RESULTS

These 43 accidents, 12.5 per cent, in 345 operations on the kidney include the entire number that have occurred in the practice of all the surgeons, including assistants and residents, connected with the urological service of the Sinai Hospital. Experience undoubtedly affects the situation since an analysis shows that 76 per cent of the accidents occurred in the first 7½ years and 24 per cent in the last 7½ years of the period covered in this study.

We have had the misfortune of dealing with all types of accidents excepting those indicated in footnote to Table I. By far the most serious accident in our experience was hemorrhage (49 per cent) from one source or another. Thirty, 70 per cent, of our accidents were major ones and the result might have been fatal; fortunately, however, only 8 patients, 20 per cent, of our series died as a direct result of the accident.

An analysis of the 8 deaths shows that 4 were from hemorrhage, 3 patients dying immediately on the table and the fourth patient 4 days after nephrectomy. One patient, following accidental puncture of the pleura and lung, developed a hydrothorax and pneumothorax after nephrectomy, which caused death. One patient with a perinephritic abscess died from sepsis and shock following rupture of the duodenum. Two patients died as a result of thrombosis of the iliac vessels, following nephrectomy. Two other deaths occurred in the series but were not attributable

directly to an accident 1 patient developed pneumonia and died on the eighth day, the other died of bichloride poisoning

In 9 cases it was necessary to sacrifice a kidney because we were unable to control hemorrhage. In 3 of these the source of the bleeding, which could not be controlled, was an aberrant vessel, and it was necessary to do a nephrectomy, in 2 cases immediately and in the other case later. In 2 of the 6 remaining cases immediate nephrectomy was necessitated by uncontrollable hemorrhage from a cut retropericolic vessel. In the 4 other cases immediate nephrectomy was necessary to control hemorrhage which resulted from an accidental injury to the kidney.

SUMMARY AND CONCLUSIONS

- 1 In 345 operations on the kidney there were 43 accidents an incidence of 12.5 per cent
- 2 Eight patients 20 per cent died, 4 from hemorrhage
- 3 Hemorrhage was responsible for 49 per cent of the serious accidents
- 4 Nine kidneys were sacrificed because of uncontrollable hemorrhage, but in these cases there were no deaths. In 3 patients the bleeding came from injured aberrant vessels, in 2 from injured retropericolic vessels, in 4 from the kidney proper
- 5 If possible all bleeding should be controlled before the patient leaves the table
- 6 Clamps should be left on the pedicle, with out hesitation when necessary
- 7 Pedicle clamps should be placed with great care
- 8 Opening of the diaphragm, the pleura, or the peritoneum is not a serious accident. If possible such rents should be closed but the renal bed should be drained
- 9 Opening into any part of the intestinal tract is a serious accident and closure should be done immediately
- 10 The fracturing of a rib or the cutting of a nerve is not a serious accident, nature will take care of such injuries

11 The proper position of the patient on the operating table, the making of an exposure sufficiently large for the operation, the exposure of the nerve, the keeping of the peritoneum well ahead of the incision, are all important factors in kidney surgery

12 The separation of adherent bands and ligation of aberrant vessels, the careful manipulation of all structures, the proper thinning out of the pedicle and the placing of clamps so that the pedicle can be ligated—all these factors will prevent many hemorrhages

13 Violent retractions should be avoided

BIBLIOGRAPHY

- 1 BEER E and HYMAN A Progress in nephrectomy—a study based on a series of 207 cases. *J Am M Ass* 1920 75 1180-1184
- 2 CRUTE A L Injury to vena cava during nephrectomy. Report of 4 cases. *J Urol* 1925 13 45-49
- 3 COWDEN C N A surgical accident. *Tr South Surg Ass* 1928 41 341-345
- 4 FELBER E Ueber Duodenalfisteln nach rechtsseitiger Nephrektomie. *Wien med Wchnschr* 1921 71 1673-1678
- 5 GUERRY, LE GRAND Injury to the vena cava during nephrectomy. *J South Carolina M Ass* 1914 10 576-586
- 6 MATHE CHARLES P Renal surgery. Its pitfalls and complications. *Calif & West Med* 1928 28 57-64
- 7 MAYO W J Accidental injuries to the descending portion of the duodenum during removal of the right kidney. *J Am M Ass* 1914 62 343-345
- 8 PHILLIPS C W Calculous pyonephrosis nephrectomy lateral ligation of inferior vena cava. *Brit. M J* 1917 2 690
- 9 PRIESTLY J T and WALTERS WALTERMAN Proc Staff Meet Mayo Clin 1933 8 302-304
- 10 QUINBY WILLIAM C The management of pneumothorax occurring as a complication of nephrectomy. *J Am M Ass* 1915 65 213-4
- 11 RATHBUN N P Some of the accidents of renal surgery. *J Urol* 1928 20 427-451
- 12 WHIPPLE Case of atrophied kidney with perinephritis abscess nephrectomy fecal fistula. *Lancet* 1892 1 471-472
- 13 YOUNG H H and COLSTON J A C Injuries to the pancreas following operation on the right kidney. *J Urol* 1917 1 179-190

PEDICLE FLAP PATTERNS FOR HAND RECONSTRUCTION

GEORGE WARREN PIERCE, M D, F A C S, and GERALD BROWN O'CONNOR, M D, F A C S,
San Francisco, California

THE delicate hand balance with its multiplicity of synchronized motions is dependent upon the normal functioning of the numerous structures of the hand, including the dermal covering. A disarrangement of any of these structures has a material effect on total and partial hand movements. We will concern ourselves in this discussion only with the coverings of the volar and dorsal surface of the hand and fingers, and the methods of repair.

In all serious hand injuries requiring dermal replacement, the damage is not confined to the skin alone but there is consequent destruction of the subcutaneous tissue. This being true, the ideal method of replacement is that which will supply a pattern of skin and subcutaneous tissue in one piece so that the optimum in hand function and appearance can be assured. From a practical viewpoint, however, under certain conditions, one may employ substitute measures which will fill the needed requirements and give gratifying results. With this thought in mind it behooves us to compare the use and application of the three standard methods of hand coverage: (1) the split skin graft, (2) the Wolfe graft, (3) the pedicle flaps as they are applied to our problem.

The split skin graft and the Wolfe graft are practically identical in their usage, but the technical difficulty in handling a Wolfe graft as well as its precarious postoperative course limits the usefulness of this type of graft. When there is a loss of the derma without exposure of the deeper structures, the split skin and Wolfe grafts are available. Of the two, the Wolfe graft functions better on the volar surface of the hand and fingers due to the fact that less contracture takes place in the grafted bed under a Wolfe than a split skin graft. The split skin graft does not wear well on the palm, occasionally being involved in a localized dermatitis or giving rise to a painful hand because insufficient protection is given to the underlying delicate hand structures. Because of its ease of application and of the more certainty of a take, the split skin graft is more frequently used on the hand and finger dorsum under limited conditions. These two grafts perform their functions best as coverings for the lateral aspects of the fingers, the

interdigital webs, including that between the index finger and the thumb and the hypothenar eminence. These are relatively silent areas with very little stress or strain and a dermal type graft is sufficient coverage. The split skin grafts are also used to great advantage as temporary measures to cover ulcers, as immediate replacement in potentially infected acute hand injuries, and in those chronic hand deformities in which there have been marked contractions requiring gradual elastic traction before full and permanent coverage is contemplated. Neither the Wolfe or split skin grafts are advisable over exposed joints, bones, tendons, or nerves and should not be used when future nerve or tendon grafts are planned. The lack of a subcutaneous tissue buffer makes them unacceptable for this type of repair.

Although the patterned pedicle flap *per se* is not our only means of hand coverage replacement, its anatomical construction fulfills the existing requirements for a more normal reconstruction than other available methods. This fact combined with their versatility of application and independent blood supply are the basic reasons why they have been so successfully employed to date and further recommends their more universal usage.

Several general principles concerning pedicle flap patterns should be considered when their use is contemplated:

1. The usual donor areas for hand repair are the abdomen, lower chest, thigh, and buttocks, the selected site depending upon the tissue availability as well as the type of material needed and the location of the injured area.

2. A one piece pattern of the exact size, shape, and thickness will give the most efficient result.

3. All pedicles and flaps, when possible, should be made to conform with Langer's skin lines and the district blood supply.

4. Venous stasis due to the lack of a blood channel outflow rather than a deficient arterial supply is generally the offending cause when tissue necrosis occurs. Multipedicle flaps correct this venous deficiency.

5. Bipedicle or multipedicle flaps are more certain of a complete take than unipedicle ones and should always be used whenever there is any question present as to the viability of the donor material.

Read before the Industrial Medicine and Surgery Section of the California Medical Association, Coronado May 23, 28, 1936.



Fig 1 *a* Burn of dorsum of hand with loss of extensor tendons. Thin scar over metacarpal bones. *b* Bipedicle abdominal flap replacing scar on dorsum of hand. *a* single

unit of skin. The abdominal skin approximated beneath hand. *c* Dorsum of hand completely covered with pattern pedicle flap cut very thin. Note how it blends with hand.

The question as to the use of more than one nourishing pedicle to the dermo subcutaneous pattern is an individual matter and depends upon the experience and judgment of the surgeon. However, there are several situations that are better met by using multipedicles: (1) when it is necessary to cut across the blood supply and Langer's lines to obtain the necessary donor material; (2) when the area to be grafted is over 1 square inch; (3) for all flap patterns on the volar surface of the hand and fingers; (4) when the pattern of the area to be grafted is irregular; (5) for total finger or thumb reconstruction; (6) when it is

necessary to reduce the subcutaneous tissue to a minimum to obtain the proper flap thickness; (7) when due to the mechanics of the hand and arm an unreasonable stress or strain is placed on the limb when it is connected to the donor area; (8) when due to malposition of the opposing areas (donor or recipient) undue tension or torsion is imposed on the pedicle or flaps.

A tubed pedicle flap in which the tubed pedicle is first made and later one end used is the best procedure for total digit covering. These pedicles may be modified at the time of application to meet the needed requirements: an example of this



Fig 2 *a* Third degree burn of hand. Tissue cooked as far as the middle of the hand. Amputation advised elsewhere but refused. *b* Abdominal tubed pedicle to index finger on the dorsal surface as far as the middle phalangeal joint and on the volar surface into the palm. *c* Second

abdominal pedicle to middle finger. Then when abdominal end is cut free the pedicle is sutured to palm and later used to cover the ring finger. *d* Another pedicle used to cover the little finger. Flexion of fingers at right angle at metacarpophalangeal joint and thumb approximates all fingers.



Fig 3. *a*, Casoline burn of hand and fingers with unyielding keloid scar holding fingers in extension. *b*, Bipedicle patterned pedicle flap to hand and fingers to replace scar

c, Complete replacement of scar on the hand and fingers permitting full flexion of the fingers and thumb

being that in which the whole volar surface, but only one-half of the dorsal surface of a digit needs replacement. Also, the same tubed pedicle just described may be used to cover other digits once having obtained its independent blood supply from its new location.

The dorsal coverings of the hand or fingers can be readily constructed by pedicle flap patterns when the abdomen is used as a donor area, because the hand can be placed in a comfortable

position. The question as to the number of pedicles required can be answered for the individual problem by adhering to the criteria stated. Usually the creation of previous tubed pedicles for flap pattern blood supply are not necessary as the direct application of the flap pattern with attached pedicles can be accomplished in one procedure. If tubed pedicles are first constructed they not only increase the number of surgical procedures and prolong the disability, but the tubed



Fig 4. *a*, X-ray burn right hand result of x-ray treatment of skin warts. Function of fingers interfered with. *b*, X-ray burn of left hand result of x-ray treatment of skin warts. Function of fingers interfered with. *c*, Complete

removal of scar and replacement with thin pedicle flap patterns from abdomen. Restoration of complete flexion and extension of fingers, as well as normal dorsal arch of hand.

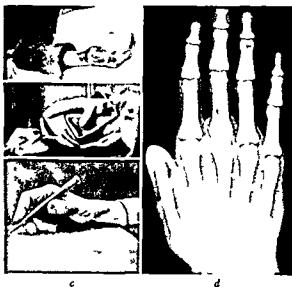


Fig 5 *a* Traumatic amputation of thumb through the proximal head of the metacarpal *b* Abdominal tubed pedicle used to reconstruct the soft tissue *c* reconstructed thumb extremely useful for approximation to fingers *d* Roentgenogram of bone graft 3 years after implant showing the density of graft and other hand bones about the same

portion *per se* when required as part of the donor material does not lend itself well to flat surface reconstruction

The replacement of the coverings of the volar surface of the hand and fingers, when the usual donor area the anterior abdominal wall, is used, presents perplexing problems due to the mechanical difficulties encountered when the hand is approximated to its donor area. These difficulties can be overcome for small areas of tissue replacement by the creation first of a tubed pedicle and

then in 2 or 3 weeks' time, by the elevation of the desired flap pattern at the appropriate tubed end. The tube not only serves as a blood supply for the flap but it also brings the flap pattern into a more accessible position for its final application. When larger flap patterns, such as to cover a palm, or palm and fingers, are required at least two tubed pedicles should be employed to insure adequate blood supply and venous return. These tubes should be so placed in regard to the flap as to insure the best nourishment for the flap as well as for obtaining the most advantageous position for the hand when the flap is applied to the denuded area.

All donor areas from which flaps are taken should be approximated at the time the flap is being used. If this is not feasible, due to the size of the skin pattern, immediate split skin grafting of the denuded donor area should be done. These grafts will take practically 100 per cent, so that eventual raw area and scar formation is materially decreased. When any flaps are applied the tissue to be replaced should be properly reflected by adequate incision to serve as a covering for the exposed surfaces of the serving pedicles. This procedure reduces the raw area, diminishes the chance for infections, and often converts an open epithelial system into a closed one.

The application and management of the grafted tissue are two other important phases of this form of reconstructive surgery. There are certain general rules to be followed if one expects to obtain the best end results.

1. The donor flap should be cut as a duplicate pattern of the denuded injured hand. This supplies sufficient covering material, keeps all the elements in the flap, including the vessels, under normal tension and in proper relation to each



Fig 6 *a* Keloid scar on dorsum of hand and fingers result of gasoline burn. Patient unable to flex fingers thumb or wrist due to the check rein like action of the dense scar *b* Hand *in situ* under abdominal glove flap. Seven pedicles can be seen one each for the fingers and thumb and one on the radial side and one on the ulnar side of the hand. Position of hand quite comfortable *c* Abdominal area

after glove pattern removed showing defect closed by split skin grafts applied simultaneously with making the pedicle pattern *d* Complete coverage of hand and fingers with a thin one piece pedicle pattern of skin after the scar was removed *e* Complete flexion of the fingers and thumb as well as restoration of normal dorsal arch and knuckles

other, thus obtaining the optimum condition favorable to flap vitality.

2 There should be an absolute hemostasis of the recipient area and the donor flap. This prevents postoperative hematomas that are so destructive to grafts and stimulates circulation in the patent flap vessels.

3 Accurate approximation of the flap pattern to its bed eliminates dead spaces.

4 Exact apposition of the flap skin edges to those of its new position puts the flap edges under the best condition for early union by first intention and gives the eventual minimum in scar formation.

The time of severance of the blood supply to any of the pedicle flaps is entirely an individual problem. The average length of time for severing accessory pedicles is 7 to 10 days and it is not advisable in the case of a large flap pattern with many pedicles to interrupt too many at the first

sitting. The average time for the severance of the terminal pedicle that makes the flap self sustaining is $2\frac{1}{2}$ weeks. There are numerous things that influence the surgeon's judgment as to the proper time to isolate the flap from its pedicle blood supply, such as (1) the rapidity of the take, (2) the size and circulation of the graft, (3) primary graft union, (4) presence or absence of infection, (5) number of nourishing pedicles, (6) the local conditions surrounding the graft, and (7) the general condition of the patient.

The pedicle flap pattern, by its anatomical construction, more closely fulfills the major requirements as a replacement tissue for all serious hand injuries requiring a covering, therefore, when properly conceived and executed it gives the most favorable means for obtaining the acme in appearance and function. It is upon these considerations that we recommend its more general application in major hand injuries.

RADICAL OPERATION FOR CANCER OF THE RECTUM WITH PRESERVATION OF THE SPHINCTER MUSCLE

ERNST GEHRELS, M D, I A C S San Francisco, California

THE operation to remove cancer of the rectum has recently been standardized in this country in practically all cases to include the routine removal of the anal sphincter. There has also been a definite trend toward the combined abdominoperineal operation.

The necessity of routinely sacrificing the rectal sphincter is debatable. In many cases sphincter preservation is justified according to recent important pathological research of Westhues.

The importance of Westhues' work is that it contradicts Miles' findings. According to Miles, cancer of the rectum, by lymphatic spread, involves the sphincter muscle, the perianal skin, and the ischio-rectal fat. If Miles is right in assuming this downward spread of cancer of the rectum, it becomes necessary to sacrifice the sphincter muscle. Practically one never finds metastases in the inguinal glands in cancer of the ampulla of the rectum.

Westhues, a German surgeon, in his recent work denies this downward spread. Westhues proves this by a thoroughness of investigation unequalled in research of cancer of the rectum.

From the Department of Surgery, Stanford University Medical School, San Francisco. Presented before the Surgical Section of the California Medical Association, Yosemite Valley, May 15, 1935.

To illustrate (1) by extracting the fat every specimen is made translucent and examined under transillumination (2) every little nodule shows clearly and is numbered, (3) serial sections of each node are examined microscopically. Westhues applied this painstaking method in 102 operative specimens, in which the most radical abdominoperineal type of operation including removal of the sphincter, had been done. There were found 210 metastatic cancer nodules. Only one of these was located below the level of the lower edge of the neoplasm. The 209 remaining were situated at the level of the cancer or above, along the hemorrhoidal artery and its branches. Westhues, therefore, is in a position to state emphatically that the perirectal tissue below the cancer is prac-

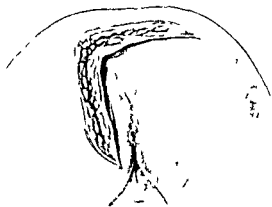


Fig. 1. Voelcker's incision for sacral operation of cancer of the rectum. (Reproduced from Nordmann, *Chirurg* 1931, p. 677.)

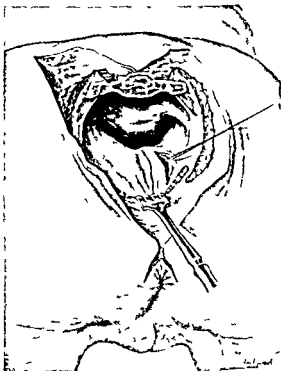


Fig. 2. Goetze operation. Showing the pelvic fascia loosened up to the promontory. Incision of cul-de-sac on right side. (Reproduced from Goetze, *Zentralbl. f. Chir.* 1931, p. 28.)

tically always free from metastases. The situation is similar to that present in cancer of the stomach. Here the lymphatic spread toward the duodenum is almost negligible compared to the upward spread along the lymphatic vessels of the lesser curvature.

In cancer of the rectum, on the other hand, Westhues further demonstrates that, in upward direction, cancerous glands originating from the tumor are usually not found higher than 10 centimeters above the neoplasm or anatomically above the level of the sacral promontory. Metastases of cancer in the glands of the mesosigmoid are not nearly as common as Miles would have us believe. If the glands of the mesosigmoid are involved, no matter how radically one operates, there is hardly any chance of a permanent cure.

Miles' well known diagram correctly pictures all possible ways of lymphatic spread. Nevertheless, for all practical purposes, we have to deal mainly with the commonly involved retrorectal glands situated along the branches of the superior hemorrhoidal artery up to the level of the promontory. Westhues' findings conclusively show that below the level of the tumor, cancer glands are not found, and that above the level of the promontory, glandular involvement is rare. As to the frequency of the lymphatic metastases, we may assume that at least 50 per cent of all rectal cancers have lymphatic involvement. The figure given by the Mayo Clinic is 43 per cent.

The above considerations refer particularly to the extramural lymphatic spread of rectal cancer.

In the spread by continuity, cancer of the rectum extends only about one half inch upward and downward beyond the visible or palpable edges of the tumor. This conforms with Miles' statement, "the spread of cancer in the submucosa is very limited and does not extend much beyond the edges of the neoplasm." If the lower edge of the malignancy is more than $1\frac{1}{2}$ inches away from the sphincter, there is no objection to saving that sphincter.

While cancer of the rectum has a tendency to remain localized within the intestinal wall for a considerable time, in a certain number of cases the malignancy will penetrate by continuity through the bowel wall and invade the surrounding perirectal tissue. Even so, the growth of the cancer does not immediately become unlimited. It hesitates a long time before breaking through the visceral fascia of the pelvis. Here again we are in conformity with Miles. It is only after penetration of the visceral fascia that the neighboring structures will be invaded, namely the sacrum, uterus, vagina, prostate, and bladder.

In other words, the visceral fascia of the pelvis forms a fairly reliable natural barrier, a musculo-membranous tube—containing the cancer in its interior. In removing cancer of the rectum the visceral fascia is a natural guide for the surgeon, an important point in operative technique.

In the operation for cancer of the rectum, the following objectives should be emphasized:

1. The retrorectal glands and the rectum covered by the natural sheath of the visceral fascia should be removed up to the level of the sacral promontory, as the lymphatic spread is in upward direction. On both the left and right sides, in the latitudinal direction all perirectal tissues should be removed as radically as possible.

2. The anal sphincter should be saved more often because the downward spread is rarely more than 1 inch from the lower edge of the cancer, either by continuity or by lymphatic extension.

To accomplish these objectives, surgery has two competing methods, namely, the combined abdominoperineal operation and the sacral route.

It cannot be denied that even in the most experienced hands, the operative mortality of the combined abdominoperineal operation is two to three times as large as that of the sacral operation. It is very doubtful whether the higher operative mortality is offset by a higher percentage of 5 year cures. The fact is, that the combined abdominoperineal operators have hardly been able to surpass the statistics of the sacral operators. It is interesting that Kirschner, one of the most experienced and progressive surgeons in rectal surgery, formerly a strong advocate of the combined abdominoperineal operation, has recently returned to the sacral procedure. Two large parallel series, comparing both methods, had shown more patients were alive 5 years after the sacral operation, than after the combined abdominoperineal operation.

If one wants to preserve the sphincter, the sacral operation has great advantages over the combined abdominoperineal procedure. Sphincter preservation means an additional risk in any type of operation. To these dangers and difficulties, the high mortality of the combined procedure would have to be added. If one sacrifices the sphincter, the entire procedure can usually be carried out in an aseptic manner. If one saves the sphincter, contamination during operation, leakage along the suture line, and bowel gangrene are to be feared, as it is often impossible to judge correctly the blood supply.

There has recently been a great advance in the technique of the sacral operation, developed on the basis of Westhues' research. This improve-

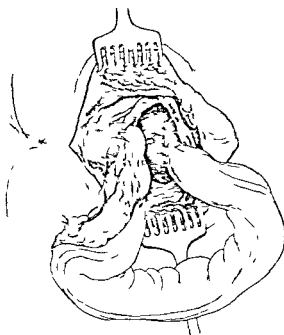


Fig. 3. Delivery of rectosigmoid from sacral wound. The sutures closing the cul-de-sac are shown. (Reproduced from Goetze, *Zentralbl f Chir* 1934 No 14, p 800)

ment is the Goetze operation which allows removal of much more tumor by the sacral route than in the usual Kraske or posterior resection type of operation. With the exception of the skin incision, I have therefore adopted the Goetze method the steps of which are as follows:

TECHNIQUE

The skin incision is made from the right side of the third sacral vertebra transversely across the midline over to the left and downward in a slight curve about 1/2 inches to the left of the midline ending on the left side of the anus. This is Voelcker's incision (Fig. 1) which I prefer to the Y shaped incision of Goetze (Fig. 2).

Not only the coccyx, but also the fifth and half of the fourth sacral vertebrae are removed.

The entire pelvic tissue is loosened in its posterior half by pushing the pelvic fascia bluntly away from the sacrum up to the level of the promontory and as far laterally as possible.

The cul-de-sac which normally extends downward to about the level of the sacrococcygeal junction is opened on both sides of the gut first to the right and then to the left of the median line.

A gauze strip is placed around the rectosigmoid from these two openings. This strip is used for

traction so that the mesorectum can be stretched and the superior hemorrhoidal vessels doubly ligated and cut at a much higher level than is ordinarily done in a sacral operation. This ligation of the artery when done in this manner will usually be above the so called critical point. In this way the main source of arterial and venous circulation of the rectum is severed at the beginning of the operation.

Now the rectum is freed from above downward, instead of in the usual way from below upward. Digging around in the cancer infested perirectal fat is in this way, entirely avoided. The sacral operation, if so done, meets all the requirements of completeness. One has to watch out for the ureters as they are carried forward with the visceral fascia by the mutual maneuver of the operation. They are much more in danger than in the usual posterior resection. I have placed catheters into both ureters immediately before the operation in difficult cases.

For the restoration of the continuity of the bowel several methods are available. The procedure depends upon whether a very short sphincter portion is left after cutting across the rectum below the tumor, or a comparatively long lower stump.

If only a very short sphincter portion can be saved Hochenegg's telescoping procedure is the best. The cut end of the bowel usually the lower most point of the sigmoid, is drawn through the anal portion. There must be no tension on the bowel. A long loop of sigmoid is required. In cases in which it is possible this procedure is satisfactory. It is simple and fairly clean, the suture line of the bowel being outside of the main wound. Full continence after the procedure is achieved in only two-thirds of the cases. The sphincter is often damaged or a fistula remains.

If there is a fairly long lower stump the restoration of continuity is more satisfactory. This is usually found in the case of an early high rectal cancer or cancer of the rectosigmoid. In this case one can do an end-to-end anastomosis of the rectum. Primary union practically never occurs. After a few days the suture line usually opens, the upper bowel becomes gangrenous and a serious pelvic infection takes place.

For these reasons I have discontinued the immediate end-to-end anastomosis of the rectum. Instead I use Klettner's method, which is a kind of Mikulicz procedure in the sacral wound. Klettner after tying the blood supply and freeing the bowel leaves a long loop of bowel with the neoplasm unoperated in the sacral wound which is protected by a gauze packing. After 24 or 48

hours, the tumor area and a large section of the bowel above and below will show beginning gangrene. Demarcation will show clearly. One can immediately resect the rectum at points which have been previously marked by a few stitches well above and below the tumor, and anastomose the bowel end-to-end. The advantage is that we are now anastomosing two bowel ends, the blood supply of which is assured, so that primary union is more often achieved. Nordmann waits until the fifth day before doing the secondary operation. No anesthetic is necessary. This procedure is painless. By waiting longer, one has the advantage of a granulating pelvic wound which is somewhat protected against infection. Due to the packing of the large wound—bacterial invasion through the gangrenous bowel wall being slow—a severe infection is the exception. This has been shown in a large series of cases.

I am using a slight modification in the manner of clamp resection by immediately resecting the bowel by cauterization over crushing Payr clamps, which being too awkward to be left in the wound are replaced by lighter, but tightly gripping, clamps immediately or at the first change of dressing. As soon as abdominal distention threatens, that is, after about 3 days, the clamps are removed and an end-to-end anastomosis can be done as previously described. If a preliminary colostomy has been performed, which I usually establish on the left side of the transverse colon, the removal of the clamps and the anastomosis may be deferred until the end of the first week after operation. I have also recently omitted the end-to-end anastomosis. The spur formation that results from a clamp resection I eliminate by "spur crushing" about 2 weeks after the operation. Spontaneous closure of the posterior wall will often take place. This is facilitated by the curved incision of the skin.

If the posterior wall of the rectum fails to unite within a few months the resulting small or large fistulous opening is closed by a secondary operation. We must mobilize the rectal wall, a step which is not easy in the scar tissue. So far, I have succeeded every time in closing the posterior defect of the rectum and achieving complete continuity and bowel control. A valuable technical help to me has been the use of a flap shaped incision of the skin at the secondary operation. This flap is very simply formed by extending the curved incision of the first operation downward on the right buttock forming a large flap with its base in the anal region. This flap is very helpful for covering the posterior line of anastomosis, and

giving support to the suture line. Persistent fistulas which may form on the sides of the flap more often heal spontaneously. If one mobilizes the upper rectal stump properly, stenosis at the suture line does not occur.

If too much bowel has become gangrenous, the gut may be too short for end-to-end suture. Usually it is at least possible to unite the anterior wall. If not even this can be done, the upper and lower lumen are left completely apart, which amounts to a sacral anus for the time being. Even in these cases, continuity can sometimes be restored. About half a year afterward, the bowel will have stretched and often will have prolapsed somewhat. Then it is usually possible to connect the upper lumen with the sphincter portion.

The Kuettner procedure requires a fairly long lower stump of the rectum, more so than Hochenegg's telescoping procedure. It is excellent for cancer of the rectosigmoid junction, which lends itself especially well to sphincter preservation and in my opinion is best handled by the Kuettner method. The advantages of this procedure are:

- 1 The main operation is shortened and shock is lessened.

- 2 Infection of the large pelvic wound does not become as serious as in the case of immediate anastomosis.

- 3 Anastomosis is done under more favorable circumstances, because at this time we are sure of perfect blood supply.

The greatest difficulty in sphincter preserving operations is to deliver sufficient length of bowel to re-establish continuity. For radical operation, we consider it essential to tie the superior hemorrhoidal artery at the level of the promontory. The entire bowel below that point may then lose its blood supply because it is not always possible to preserve the marginal arc, which necessitates drawing on the sigmoid to re-establish continuity. This is only possible if there is a long loop of sigmoid. All cases of short sigmoid, especially in stout patients, are unfit for this type of sphincter-saving operation. Our efforts to save the sphincter are limited on one side, by the proximity of the cancer to the sphincter muscle, and on the other side by the shortness of the sigmoid loop. Sphincter preservation is possible only in selected cases. The age of the patient, his resistance, the grade of the malignancy of the cancer, the length of the mesosigmoid, must be considered. The final decision can be made only during operation. Although a barium enema will give one a fair idea as to the length of the sigmoid, one cannot promise the patient restoration of continuity before the operation.

How often the sphincter can be saved varies in the experience of different leading continental surgeons. Two of the largest series are those of Hochenegg of Vienna and Kuettner of Breslau. Hochenegg reported almost 1000 radical operations, in about 250 of which the sphincter could be saved. Of these 33 per cent were 5 year cures. Kuettner among about 600 radical operations, restored continuity in about 250, with a 5 year cure of 40 per cent. In 1934, Finsterer reported 179 excisions of the rectum for cancer. The sphincter was saved in 127 cases equal to 70 per cent. In 65 of these 127 he operated by the abdominoperineal route (mortality 23 per cent), in 62 by the sacral route (mortality 8 per cent).

The procedure is further complicated by the necessity of decompressing the bowel. In all cases, except the most favorable unobstructed ones I prefer to do a preliminary colostomy. The great advantage of a preliminary colostomy is not only the detoxication of the patient but also the protection the colostomy affords to the sacral wound, and to the suture line of the rectum. At this time it is important to explore the abdomen for liver metastases, the extension of the neoplasm, the presence of metastatic glands, etc. These factors will determine whether sphincter preservation should be attempted or not.

The procedure, of which I have been discussing the different steps means a 4 stage operation.

- 1 Low midline exploratory laparotomy. Colostomy on the left side of the transverse colon from a separate stab incision.
- 2 Main operation by Goetze method.
- 3 The third major stage consists of closing a posterior defect of the rectum, utilizing the large skin flap already partly formed at the second operation.
- 4 The fourth stage is the closure of the transverse colostomy.

In favorable cases the exploratory laparotomy and preliminary colostomy can be omitted, making only two, or even one, operation necessary if primary union of the rectum takes place. While the four stage procedure is tedious it greatly diminishes the dangers peculiar to the segmental resection of the rectum. If the patient achieves normal bowel control the result justifies the prolonged procedure.

In an abdominoperineal operation continuity can be restored in the same manner as in a sacral operation. In using an abdominoperineal operation many variations in procedure are possible which cannot be discussed within the scope of this article. When restoring continuity in an abdominoperineal operation I prefer again to use the

Kuettner principle namely, the delivery of the sigmoid loop into the sacral wound with immediate clamp resection and later anastomosis. Only the cutting of the superior hemorrhoidal artery and mobilizing of the rectosigmoid are done from the laparotomy.

For the surgeon who becomes familiar with the improvements in the sacral operation afforded by the Goetze procedure, the delivery of a cancer of the pelvic colon entirely from below appears so satisfactory that the combined abdominoperineal operation becomes less and less often necessary. The exceptional cases, such as large adherent tumors of the rectosigmoid, will be recognized at the time the colostomy is performed. These will be subjected to an abdominoperineal operation with or without sacrifice of the sphincter.

Occasionally one will find more favorable conditions at the time one intends to do the colostomy than one had expected. In this case I have utilized the laparotomy for immediate mobilization of the sigmoid and rectosigmoid, cutting the superior hemorrhoidal vessels and then delivering the rectosigmoid from a quickly established sacral wound. It must be admitted that preservation of the marginal arc of the rectosigmoid is easier when done from a laparotomy. The clamp resection is done in the posterior wound and the continuity restored at a later date.

The procedure just described and the 4 stage operation previously outlined appeal most to me at the present time.

SUMMARY

- 1 According to the recent valuable research of Westhues a downward spread of cancer of the rectum occurs only very exceptionally. A distance of $1\frac{1}{2}$ inches between the anal sphincter and the lower edge of the neoplasm permits one to attempt sphincter preservation.
- 2 Cancer of the rectosigmoid and early cases of malignancy in the rectal ampulla deserve the attempt to restore rectal continuity and normal bowel control.
- 3 Sufficiently radical surgery can be done from the sacral route by employing the new sacral operation of Goetze.
- 4 The technical difficulties of restoring the continuity can be overcome by the Kuettner method, or better, a clamp resection in the sacral wound, sometimes by the telescoping procedure. A preliminary colostomy on the left side of the transverse colon is usually advisable.
- 5 The temptation to operate too close to the neoplasm must be strictly avoided if preservation of the sphincter is attempted.

6 Only in selective cases should preservation of the sphincter be attempted. Age of the patient, constitutional type, length of the sigmoid, and other factors must be considered, the decision to be made during the operation

REFERENCES

- 1 EICHHOFF, E. Beitr. z. klin. Chir., 1922, 125, 50
- 2 FINSTERER, F. Med. Klin., 1934, 13, 426
- 3 GOETZE, O. Cancer of the rectum, suggestions for the sacral and abdominosacral operation. Zentralbl. f. Chir., 1931, 28, 1746
- 4 Idem. The choice between the sacral and abdominosacral operation with discussion of the last papers of Goepel and Mandl. Zentralbl. f. Chir., 1932, 14, 1878
- 5 Idem. Two stage operation for cancer of the rectum. Zentralbl. f. Chir., 1934, 14, 796
- 6 HOCHENEGG, J. Wien. med. Wochenschr., 1929, 594
- 7 KUETTNER, H. Med. Klin., 1929, 25, 428
- 8 MANDL, F. Arch. f. klin. Chir., vol. 136, 479
- 9 Idem. Deutsche Ztschr. f. Chir., 1922, 223
- 10 Idem. Extensive operation by sacral route. Zentralbl. f. Chir., 1932, 59, 594
- 11 Idem. Cancer of the rectum, diagnosis, indications and therapy. Med. Klin., 1934, 30, 1326
- 12 MILES, W. L. Pathology and spread of cancer of the rectum. Surg., Gynec. & Obst., 1931, 52, 350
- 13 NORDMAN, O. Sacral operation of cancer of the rectum by the method of Voelcker. Kuettner Chir., 1931, 15, 44
- 14 SÄUERBRUCH, H. Med. Klin., 1928, 24, 1666
- 15 VERDI, W. F. Resection and continuity restored in the operation of cancer of the rectum. Ann. Surg., 1929, 90, 699
- 16 WESTHUES, H. Pathologic Anatomical Foundations of Surgery in Cancer of the Rectum. Leipzig: G. Thieme, 1934

TRANSVESICAL CLOSURE OF VESICOVAGINAL FISTULAS

Employment of the Young Technique for Inaccessible Vesicovaginal Fistulas

MARION DOUGLASS, M D, F A C S, Cleveland, Ohio

CLOSURE of high vesicovaginal fistulas is one of the most difficult and exacting of all surgical procedures. The fistulas in portions of the anterior vesical wall, which are easily available and in which the uterus is *in situ*, may on the other hand be operated upon relatively easily by the classical method or one of its numerous modifications. The majority of gynecologists have always favored vaginal closure by the Sims method and attack by other routes has in the past been criticized as unnecessary or ill chosen. However in certain cases it is wise to borrow a leaf from the book of the urologist.

I wish to report 4 cases of difficult vesicovaginal fistulas each closed in one attempt by the transvesical route, originally proposed by Trendelenburg.

This method was first employed by Young in a patient who had been subjected to eleven previous unsuccessful operative attempts to repair the fistula. This number of failures is in itself a strong suggestion that another technique beside the classical method of closure has its place in certain cases. The essential cardinal principles originally developed by Marion Sims, of good exposure, closure by suture and catheter drainage apparently are not always obtainable.

By a deep Schuchardt incision many comparatively inaccessible fistulas (Ward) can be reached and the objection has been raised that the transvesical approach is unnecessary. In our hands however, it has been of value in cases with marked fixation due to repeated unsuccessful attempts at closure and particularly in those cases in which the fistula is closely adjacent to the ureteral orifice, or those in which the uterus has been removed. Transperitoneal closure has been advocated by Legueu and recently by Walters, the latter employing the omentum as a dam plugging the opening.

CASE 1: This patient was a white married woman aged 45 who had had a total hysterectomy 2 years previously by another surgeon. She had developed a vesicovaginal fistula at the time of her discharge from the hospital. An unsuccessful attempt at closure was made on March 9, 1927 by the classical method catgut being used. The fistula was posterior to the interureteric ridge slightly to the right and about 1 centimeter posterior to its median

portion. Due to its marked inaccessibility at the apex of the vaginal vault it was decided to attempt the transvesical method as advocated by Young.

Suprapubic incision was made (Fig 1). The fistula was elevated by means of a safety pin in the form of a hook and the mucosa was carefully incised and reflected from the fistula. Concentric pursestring sutures were placed and tied thus evaginating the fistula into the vagina. The mucosa was sutured with interrupted chromic catgut No. 00 and the anterior bladder wall was closed with interrupted plain catgut sutures and the fascia approximated with interrupted chromic sutures. A large suprapubic catheter was inserted.

This patient was placed on the abdomen as advised by Young and Chute and she was kept in this position for 13 days. We have employed this method in all such cases and regard it as extremely valuable in protecting the vesicovaginal uterine bladder being kept entirely empty. This patient developed a small postoperative ventral hernia which was repaired a year later. She has had no further leakage.

CASE 2: The patient was a married woman aged 36 years who entered the hospital April 13, 1929. She complained of urinary incontinence. She developed a fistula following a radical Wertheim operation for squamous cell carcinoma of the cervix.

Cystoscopy revealed a vesicovaginal fistula $2\frac{1}{2}$ centimeters from the right ureteral orifice about 1 centimeter posterior to the interureteric ridge. Suprapubic cystostomy was performed exposing the floor of the bladder. The fistulous opening was readily seen and was elevated on a small hook. The mucosa was incised transversely and the mucosa undermined distally which denuded a small elliptical area of vesical musculature. A silk pursestring suture was laid in this area. Several interrupted sutures of plain interrupted catgut as advocated by Young were superimposed. We did not hesitate to use 1/2 and fine chromic catgut for the superimposed interrupted sutures as well as the mucosal stitches. This patient was placed on her abdomen and suprapubic catheter drainage was employed. This patient was discharged on the seventeenth day. She has remained free from recurrence of leakage.

The first 2 cases were done in conjunction with Dr. James Joelson of the Urologic Service of the Lakeside Hospital.

CASE 3: This patient was a white married female, aged 42 years who had been operated upon three times unsuccessfully for closure of vesicovaginal fistula. Cystoscopy revealed a fistulous tract anterior to the left ureteral orifice quite high in position in a line approximately 1 centimeter from the urethra and in the line between the urethral orifice and the left ureteral orifice. The fistula was repaired with the same technique through a suprapubic incision and a mushroom catheter was placed in the bladder. Recovery was uneventful. The patient was able to void spontaneously. She was kept face downward 12 days when the catheter was removed from the suprapubic incision. The wound healed rapidly. The patient was dis-

From the Department of Obstetrics and Gynecology, Western Reserve University School of Medicine and the University Hospitals.

charged on the fifteenth day, voiding normally and completely continent.

CASE 4 A white woman, aged 30 years, developed incontinence of urine following panhysterectomy in another state from an unknown cause. This is a patient of Dr. Herschberger of Tiffin, Ohio. Cystoscopy revealed a fistulous opening approximately in the midline just posterior to the interureteric ridge. Closure by the classical method was attempted. A modified Schuchardt incision was made, the repair being attempted with No. 0 chromic catgut by the method advocated by Lower. This operation was unsuccessful, leakage recurring in 6 days and 1 month later the patient was operated upon by the transvesical route. Two pursestring sutures of No. 00 catgut were placed about the fistulous tract which was everted toward the vagina. The mucosa was then closed with No. 00 chromic catgut sutures, the tract having been well elevated by means of a safety pin, made into a hook. Suprapubic drainage was made with a large tube as in the other cases in this series. The patient was kept on the abdomen. The indwelling catheter was removed on the fourteenth day and the patient was discharged on the thirty third day after the second operation. She has remained free from recurrence of leakage.

We have employed suprapubic drainage into the space of Retzius for 24 to 36 hours in addition to the vesical tube. We have also found elevation of the fistula by means of a small hook or safety pin, following the suggestion of Dr. Young, superior to elevation on an assistant's finger in the vagina, although theoretically the latter maneuver should allow the best exposure. The exposure, however, of an indurated fistula on a small hook is eminently satisfactory and experience with this method has been highly gratifying and we feel justified in recommending it particularly in cases in which, due to absence of the cervix or inaccessibility of fistula through scar tissue fixation, adequate exposure from below, even aided by the Schuchardt incision, is difficult.

The availability of the operative field and the relatively easy exposure of the fistula can scarcely be imagined by one accustomed only to employing the much more difficult classical approach in cases in which there is no cervix uteri to use for

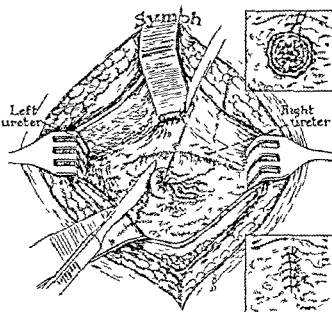


Fig 1 Circumcision of vesical mucosa surrounding the vesicovaginal fistula by an elliptical incision. The surrounding mucosa is gently and carefully elevated and dissected away from the site of the fistula leaving a small raw area of bladder muscle. The fistula is posterior to the interureteric ridge and slightly closer to the right ureter. Right upper inset shows concentrically placed pursestring sutures. As these are tied from within outward the fistulous tract is everted toward the vagina. Three pursestring sutures are placed. Lower right inset shows mucosa closed with interrupted catgut sutures.

traction. The field can be kept absolutely dry, sutures can be placed accurately with little or no trauma of tissue, and we feel justified in recommending it as the method of choice in the treatment of small but inaccessible vesicovaginal fistulas.

REFERENCES

1. CRUTE, A. A suggestion for postoperative vesicovaginal fistula. *J Urol* 1921 77-81.
2. LOWER, W. Repair of vesico and urethral fistulae. *Am J Surg*, 1935, 28 234.
3. YOUNG, H. Repair of vesicovaginal fistulae by use of a new instrument. *Surg, Gynec & Obst* 45 226.

CELLULITIS OF THE NECK REQUIRING TRACHEOTOMY

GORDON B. NEW, M.D. F.A.C.S., Rochester, Minnesota

CELLULITIS of the neck does not, as a rule, produce sufficient obstruction of the upper part of the respiratory tract to require tracheotomy, but I am reporting 5 cases in which this was necessary in the last 10 years. In 3 of these cases the patients had a diffuse cellulitis and thyroiditis following infection of the upper part of the respiratory tract, in 1 case the patient had exophthalmic goiter, thyroiditis and an abscess of one lobe and the isthmus of the thyroid gland, and in 1 patient a diffuse cellulitis of the buttocks, a spreading cellulitis of both parotid regions and the neck, and pneumonia developed after a hysterectomy had been performed.

Patients who have infections of the neck are treated with large hot, moist dressings which should be changed every hour. If inflammation is present in the mouth or throat, hot irrigations also are used. If the patient is unable to take sufficient fluids by mouth because of swelling of the pharynx a Rehfuss tube is passed through the nose into the stomach. If edema of the larynx occurs steam inhalations are used and in cases in which it is indicated an oxygen tent is employed.

Irradiation is of definite value in the treatment of certain infections of the neck. The parotitis associated with upper abdominal operations is greatly benefited and is sometimes cleared up by the use of radium packs if used immediately after the onset of the infection. Certain diffuse board like infections of the neck have been entirely cleared up without drainage by the use of x ray therapy.

Drainage of the phlegmon is performed by means of intravenous administration of pentothal sodium, except in cases in which there is partial obstruction of the respiratory tract, in such cases, a spray of ethyl chloride is employed. Anesthetizing a patient for drainage of a phlegmon of the neck when the upper portion of the respiratory tract is partially obstructed may cause complete obstruction and necessitate an emergency tracheotomy. A small incision is made in the skin over the point where the phlegmon is becoming localized and a curved hemostat is passed into the pocket and spread. A fairly stiff cigarette drain

From the Section of Laryngology, Oral and Plastic Surgery, The Mayo Clinic. Read before the meeting of the American Laryngological Association, Atlantic City, New Jersey, May 31, June 1 and 2, 1937.

age tube, 0.75 centimeter in diameter, is inserted and sutured to the skin with silk (Fig. 11).

REPORT OF CASES

CASE 1. The patient was a butcher, aged 47 years. His general health had been excellent previous to the onset of swelling of the neck and difficulty in swallowing and breathing. Three weeks before the patient came to The Mayo Clinic he had noticed a tickling sensation in his throat and later had had a sore throat. Two weeks later he had noticed a swelling of the right side of the neck which had gradually increased in size and extent. He had some fever, he had been able to swallow but little in the last few days before he came to the clinic and he had had dyspnea on exertion. He was greatly bothered by mucus in his throat.

Examination disclosed a diffuse hard cellulitis of the right side of the neck which was spreading across the midline (Fig. 1). There was no fluctuation. There was marked edema of the pharynx and larynx on the right side. The patient was hospitalized, his temperature was 104 degrees F. and his pulse rate was 130 beats per minute the first night he was in the hospital. General examination did not disclose any other abnormality. An intranasal tube was inserted into his stomach for the administration of fluids. Large hot dressings were applied outside the neck and a steam tent was started. The patient seemed to get along fairly well during the first 24 hours, but the second night he had increased edema of the larynx and pharynx and increased difficulty in breathing. The trachea on the right side of the larynx moved up and down with respiration but there was no cyanosis. A tracheotomy was performed.

At the time of the tracheotomy a diffuse cellulitis of the neck had eliminated the landmarks such as the hyoid bone, the larynx and the trachea. A midline incision was made and the larynx and trachea were found displaced 5 centimeters to the left. In the midline a small amount of pus seeped into the wound from the right side. This was packed off and the cricoid cartilage was elevated with a hook so that the isthmus of the thyroid gland could be divided. There was a diffuse cellulitis. The trachea was opened above the second tracheal ring. A small rubber tube was inserted into the right side of the wound where the pus had come from. The tracheal tube was inserted and the wound packed wide open with iodoform gauze (Fig. 3). The application of hot dressings was continued over the neck.

The patient continued to be irrational for 2 days. His pulse rate and temperature however gradually decreased (Fig. 3). On the seventh day after the tracheotomy a phlegmon was drained on the right side of the neck and about 5 ounces (about 150 cubic centimeters) of pus was evacuated and a rubber cigarette drainage tube about 0.75 centimeters in diameter was inserted. Nine days following the tracheotomy the edema of the laryngeal tissues had practically disappeared. The swelling of the neck was reduced and the tracheal tube was removed. On the eleventh day the Rehfuss tube was removed and the patient was able to swallow without difficulty. Following this, he made an uneventful recovery.

CASE 2. A school teacher a woman aged 24 years, had been well until 2 weeks before she came to the clinic when she had noticed some lacrimation of her eyes which had

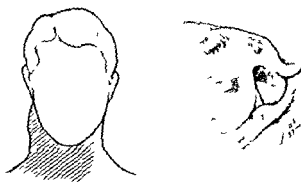


Fig. 1 Diagrammatic drawing showing diffuse cellulitis of the neck and edema of the larynx in Case 1

cleared up on the third day. The next day she had ached all over and had felt as if she had 'flu', she had gone to bed. Five days before she came to the clinic she had noticed swelling and soreness of the throat and difficulty in swallowing. Four days later her throat had felt better but the neck had continued to swell and the patient had noticed difficulty in breathing and swallowing and a collection of mucus in her throat.

Examination revealed edema of the epiglottis, hypopharynx and arytenoid region grade 2 on a basis of 4, a diffuse inflammatory induration over the lower anterior portion of the neck in the region of the thyroid gland and tenderness which was most pronounced just to the right of the midline. Diffuse cellulitis and thyroiditis were present but there was no fluctuation. Her temperature was 102 degrees F and her pulse rate was 110 beats per minute (Fig. 4). General examination did not disclose any other abnormality. The patient was hospitalized, hot dressings were applied over the neck and steam inhalations were started. The first night due to the increased edema and difficulty in breathing a tracheotomy was done in the patient's room. No further drainage of the phlegmon of the neck was instituted but some pus drained into the wound. The temperature gradually went down and was normal on the sixth postoperative day; convalescence was uneventful.

CASE 3. The patient was a farmer, aged 40 years. Three weeks before he came to the clinic he had noticed a soreness in the neck while he had been threshing. He had stayed at



Fig. 2 Bilateral diffuse cellulitis of the neck. Reflux nasal feeding tube, tracheotomy tube to the left of the midline and cigarette drainage tube below this.

home for 2 or 3 days and then had resumed work. The soreness had continued and the patient had gone to an osteopath for treatment. Four days before he came to the clinic he had been forced to go to bed on account of the swelling and soreness of the neck and he had used cold applications. He had had some dyspnea and some dysphagia since that time.

Examination showed diffuse cellulitis of the neck, which was more marked on the right side and a diffuse thyroiditis (Fig. 5). The patient entered the hospital during the night. His temperature was 102.5 degrees F and his pulse rate was 110 beats per minute (Fig. 6). The next morning it was necessary to do an emergency tracheotomy because of the increased dyspnea secondary to the swelling of the neck, marked bulging of the lateral wall of the pharynx and larynx and edema of the epiglottis and larynx on the right side. At the time of the tracheotomy there were no landmarks visible. A midline incision was made and the trachea was found displaced to the left and was located with difficulty. While we were attempting to find the trachea, a small amount of pus seeped into the wound from

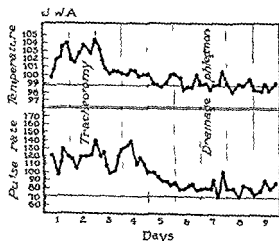


Fig. 3 Temperature chart in Case 1

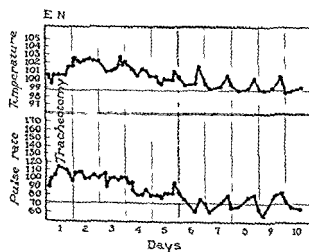


Fig. 4 Temperature chart in Case 2



Fig 5 Diagrammatic drawing showing the diffuse cellulitis of the neck and edema of the larynx in Case 3

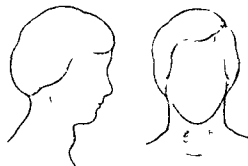


Fig 7 Diffuse thyroiditis and cellulitis of the neck in Case 4

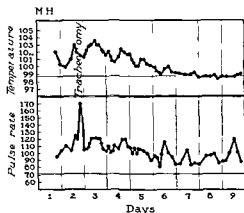


Fig 6 Temperature chart in Case 3

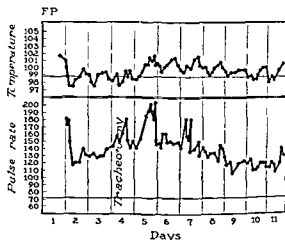


Fig 8 Temperature chart in Case 4.

the right side. At that time the patient had stopped breathing for a minute and he was cyanosed when the trachea was opened. Breathing was resumed and the cyanosis disappeared as a result of artificial respiration and the administration of oxygen. A curved forceps was passed into the right side of the wound where the pus had seeped in and a small drainage tube 6.75 centimeters in diameter was inserted. The wound was packed wide open with iodoform gauze and the patient placed in an oxygen tent for several hours. Although he was very ill for 2 or 3 days his temperature gradually subsided and his general condition improved. His temperature was normal on the tenth post operative day.

CASE 4. The patient was a stenographer a woman aged 32 years. Two and a half weeks before she came to the clinic she had become ill with swelling of the left anterior portion of the neck, a high fever and chills. She had been treated with ice packs. At that time the neck had been swollen even with her chin. The phlegmon had drained out onto the neck (Fig 7). Examination at the clinic disclosed that the patient had lost 10 pounds (4.5 kilograms). She had no appetite. She had dyspnea grade 2 on a basis of 4 and there was a draining sinus in front of the neck, which communicated with the left lobe and the isthmus of the thyroid gland. Her pulse rate was 130 beats per minute, her temperature was 101.8 degrees F (Fig 8). She was hospitalized and put into the oxygen chamber, hot dressings were applied over her neck and compound solution of iodine (Lugol's solution) was given on account of a diag-

nosis of exophthalmic goiter and an abscess of the left lobe and the isthmus of the thyroid gland.

Examination of the larynx showed very little movement of either vocal cord, swelling in the left subglottic region and left trachea and marked respiratory obstruction. There was considerable edema of the left side of the larynx. A curved forceps was passed into the draining sinus, the patient obtained some relief and was kept in the oxygen chamber for about 2 days. Then it became necessary to open the trachea on account of the increased dyspnea. She made a very slow convalescence as a result of the deep infection about her trachea and neck. Three months later both cords moved normally and a thyroidectomy was performed.

CASE 5. A woman aged 60 years had undergone a subtotal abdominal hysterectomy and bilateral salpingo-oophorectomy for a cyst adenocarcinoma grade 2. Two days after the operation a bullous edema of the buttocks developed and spread rapidly. It appeared like an erysipelas. The next day a diffuse swelling occurred in the left parotid region and following that the right parotid region was infected. Radium treatment was used and fluids were given intravenously. Blood cultures were negative. The spreading of the infection continued into the neck so that both sides and the anterior portion of the neck were involved (Fig 9). The patient was placed in an oxygen tent.

Examination 4 days after operation disclosed that the hypopharynx and laryngeal mucous membranes were

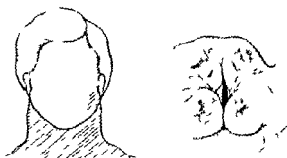


Fig 9 Diagrammatic drawing showing bilateral diffuse cellulitis of the neck and parotid regions and laryngeal edema in Case 5

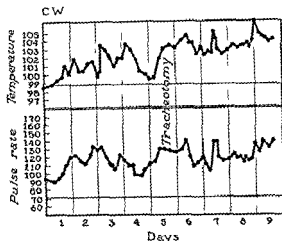


Fig 10 Temperature chart in Case 5

markedly edematous. The vocal cords could not be seen because of the edema of the lateral walls of the larynx. The edematous mucous membrane was sucked together during respiration. At the time of this examination there was marked obstruction of respiration and a tube was placed in the trachea through the mouth following this, a tracheotomy was done in the patient's room. Roentgenologic examination of the thorax revealed bronchial pneumonia. The patient was returned to the oxygen tent; her condition became gradually worse (Fig 10) and she died 11 days following the operation.

This group of cases of cellulitis of the neck in which tracheotomy was required emphasizes the well known fact that tracheotomy should always be performed early whether the cause of the respiratory obstruction is infection or neoplasm. Many patients who have cellulitis of the neck have some edema of the pharynx and larynx, but drainage of the phlegmon usually causes the



Fig 11 Phlegmon of the right cervical region showing cigarette drainage tube in place

edema to subside. However, in the case in which the edema is progressive and there is no fluctuation in the neck to suggest where the diffuse cellulitis is localizing, an early tracheotomy is advisable. In the cases reported, tracheotomy had to be performed through the diffuse cellulitis but it did not produce any exacerbation of the infection as it is sometimes believed to do. The wounds were packed wide open with iodoform gauze to permit drainage. The diffuse cellulitis cleared up promptly following the tracheotomy and drainage of the phlegmons. The patient who had exophthalmic goiter and the abscess of the thyroid gland did not recover so rapidly, because of the extent and the diffuse character of the abscess. The patient who had undergone a hysterectomy was so acutely ill with a severe generalized infection and bronchopneumonia that the cellulitis of the neck was only an additional complication, and it appears that the patient would have died regardless of this. In diffuse cellulitis of the neck without localization and with increasing upper respiratory obstruction, tracheotomy should be performed early.

TOTAL GASTRIC RESECTION

An Experimental Study

IRANK GLENN, MD FACS New York New York

IN an effort to overcome some of the difficulties and unsatisfactory results encountered in total gastric resections, a new operation has been devised and practiced on dogs. A brief description of the procedure and of the results obtained with it experimentally will be found in the following pages.

The operation is performed in two stages separated by an interval of 2 or 3 weeks.

The first stage The abdominal cavity is entered through an upper midline incision and the omentum is reflected to the left upper quadrant. The optimal exposure of the operative region is obtained by a three fold manipulation of the stomach carried out in the following manner: (1) it is drawn down to place tension on the esophagus; (2) its fundus is rotated to the right to expose the esophageal hiatus and the structures lying directly behind the stomach and below the diaphragm; and (3) it is drawn forward to bring into view the muscles which form the posterior portion of the esophageal hiatus. When completed these manipulations disclose an area which contains no structures lying between the mesenteric vessels where they branch off of the large vessels posteriorly and the lowermost portion of the mediastinum. The peritoneum in this area is incised and the aperture enlarged to 2 or 3 centimeters in length. Through this opening the mediastinum is dissected off of the esophagus which lies directly anterior to it. Care must be exercised during this procedure to avoid opening the mediastinum. A tape is now placed in the aperture to hold the esophagus forward and this region is temporarily abandoned until the optimal intestinal loop for the anastomosis has been selected. A segment of jejunum beginning about 15 to 20 centimeters below Treitz's ligament has been found best for this purpose. It must be sufficiently long and free to reach to the level of the diaphragm and pass through the aperture just described, without undue tension. A trial may be made to ascertain which loop of bowel best lends itself to this displacement. The selection made. 6 silk sutures are placed at $\frac{1}{2}$ centimeter intervals and lengthwise of the intestine,

into the segment of jejunum midway between its mesenteric attachment and the opposite free side, i.e., at a distance from the mesentery of about one quarter of the total circumference of the intestine. The straight needles used to introduce these sutures are now discarded. Unthreaded the three sutures nearest the stomach are carried through the aperture and with them the portion of jejunum through which they run (Fig 1). This brings the proximal half of the loop to the point where esophagus and diaphragm meet to the right of the midline. The other half of the loop with the other three sutures remains on the left of the midline at the same level (Fig 2). The sutures are now threaded onto curved needles and passed through the crural fibers of the diaphragm and the posterior wall of the esophagus (Fig 3). Each suture is tied separately and at the end of the procedure a firm union has been obtained between the diaphragm, the esophagus just proximal to the gastro-esophageal junction, and the duodenum. The greater part of the posterior half of the esophageal wall is included in this union.

The loop of jejunum displaced in this way is exposed to danger of obstruction by acute angulation or by pressure upon it by the stomach. As a safety measure therefore an entero-enterostomy is made between the proximal and distal limbs of the jejunum at a point where these two segments naturally approach each other. This point is usually a few centimeters distal to Treitz's ligament. The method originally described by Halsted is employed for the lateral anastomosis. Following this procedure, the abdomen is closed and the dog is permitted to recover from operation. He is fed the usual canine diet for 2 or 3 weeks when he is subjected to the second stage operation.

The second stage consists in the gastric resection and the completion of the anastomosis of esophagus and jejunum. The abdominal cavity is entered through the original wound and the omentum is again reflected to the left upper quadrant. With the stomach exposed from the diaphragm to the duodenum, the vessels first of the greater and then of the lesser curvature are ligated and cut. The stomach is resected at its junction with the duodenum and the duodenal stump is closed.

From the Department of Surgery of the New York Hospital and Cornell Medical College

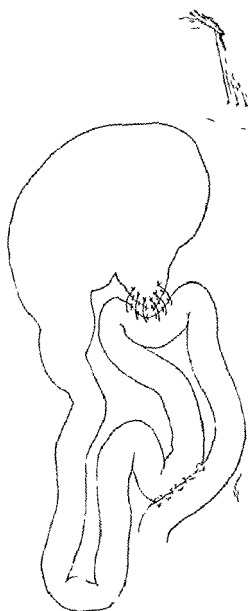


Fig. 1 The diagram shows the relationship of the jejunal loop to the esophagogastric junction and the position of the sutures three on each side of the midline. The insert shows the sutures in place in the wall of the intestine at the site of the intended stomach.



Fig. 2 Three of the sutures previously placed in the intestinal wall have been passed through the aperture directly posterior to the esophagogastric junction carrying with them the segment of jejunum.



Fig. 3 The sutures have been threaded onto curved needles and are passed through the crural fibers of the diaphragm and posterior wall of the esophagus.

and inverted. With the free pyloric end of the stomach drawn outward and forward, the site of the first operation and of the point of union between esophagus and jejunum and diaphragm comes into view. Two Kocher clamps are placed across the esophagus above but close to the gastro-esophageal junction and the stomach is resected between these clamps, the actual cautery or the phenol alcohol technique being employed in the transection (Fig. 4). With the stomach removed, the anastomosis of jejunum and esophagus may be completed, it is carried out according to the

Halsted method, the line of sutures placed in esophagus, jejunum, and diaphragm at the first



Fig. 4 With the stomach free up to the esophagogastric junction two Kocher clamps have been placed across the esophagus just distal to the suture line established at the first operation. The stomach will be resected between these two clamps.



Fig. 5 The anastomosis is shown nearing completion. The mattress sutures in the anterior wall of the anastomosis are in place. The continuous suture placed through the wall of jejunum and esophagus to form the inner aspect of the posterior wall of the anastomosis can be seen.

operation forming the posterior wall of the anastomosis. To facilitate exposure and to hold jeju-



Fig. 6 The mattress sutures have been tied and the reinforcing sutures have been placed between them. The duodenal stump has been inverted and secured to the peritoneum of the posterior abdominal wall. The entero-enterostomy established in the first stage operation can be seen.

num and esophagus in alignment traction sutures are introduced, one at either end of the line of union. Traction on them brings the structures forward, and in this position mattress sutures are placed about 0.5 centimeter apart and extending the full length of the intended stoma. In introducing these sutures it must be borne in mind that they are to unite the jejunum and esophagus to form the anterior wall of the anastomosis, therefore, they must encompass an area sufficiently large to allow the stoma to be made, when tied they should bring the two structures together at a distance of about 1 centimeter from the posterior suture line already present. The row of sutures completed they must be separated so that the opening in the jejunum may be made. To do this, a clamp is inserted between the central mattress sutures and passed to the end of the line under this half of them where it is made to grasp the traction suture and to draw it through



Fig 7 Roentgenogram showing barium visualization of the anastomosis

under the mattress sutures to the center. The same maneuver is carried out on the other side and the mattress sutures are separated and reflected to either side by pulling on the traction sutures. The jejunal wall is now incised parallel to and 0.5 centimeter from the posterior suture line introduced in the first stage operation. Bleeding vessels are caught and ligated with plain catgut (No 00) as soon as the opening is made. The clamp on the esophageal stump is removed, the material which escapes is withdrawn by suction, and the vessels are clamped and tied. A continuous lock stitch of plain catgut (No 0) is now carried around the posterior aspect of the stoma through the entire wall of jejunum and esophagus, joining them to form the inner side of the posterior wall of the anastomosis. When all bleeding from esophageal and intestinal surfaces has been controlled, the mattress sutures are drawn up (Fig 5), while the anterior walls of the two structures are being approximated in this manner, the mucosa is carefully inverted. Each suture is tied separately and fine silk sutures are placed between them to reinforce the closure (Fig 6).

The anastomosis completed, attention is directed to the duodenal stump, it is sutured to the peritoneum of the posterior abdominal wall with



Fig 8 Photograph of specimen removed from a dog 3 months after the second operation. The esophagus and intestine have been injected with formalin.

a few interrupted stitches. The abdomen is closed without drainage.

RESULTS OF THE OPERATION IN EXPERIMENTAL ANIMALS

Twelve animals have been subjected to the procedure described. The first 3 dogs died of peritonitis and due to the following causes, in the first, postmortem examination revealed a defective suture line in the anastomosis with necrosis in the wall of the esophagus. The second showed tearing of the intestine by the sutures, the third exhibited no traces of defect in the anastomosis. All 3 dogs died within 5 days of the second stage operation. A fourth animal died of distemper 6 days after the first operation. Autopsy showed the loop of jejunum properly secured and firmly attached to the diaphragm and esophagus, the entero-enterostomy appeared to be functioning satisfactorily as the loop of jejunum was not distended. Dogs 5 and 6 were carried through both stages of the procedure

successfully and lived for 3 months after the second stage, at the end of this time they were sacrificed in order to obtain specimens for study. Both of these dogs showed rather marked anemia, though blood studies were not made to corroborate this impression. Animal 7 lived 21 days after the second operation. Autopsy failed to show the cause of death and it was believed that the fatal outcome in this dog was due to the marked anemia which again was present. Animal 8 died as the result of the anesthetic during the second stage operation. Dog 9 was in good general condition 30 days after the second operation. A roentgenographic examination at this time showed marked narrowing of the intestinal lumen at the site of the anastomosis and dilatation of the esophagus above this point (Fig 7). The dog was sacrificed to obtain the specimen. Grossly the lumen of the intestine at the point where the constriction was evident in x ray film was not smaller than elsewhere. The amount of scar tissue at this point was negligible. It was believed that the narrowing of the lumen seen in the x ray picture was due to spasm. Animal 10 was sacrificed 60 days after the second stage operation. His condition at this time was not good; he was not eating well and was markedly anemic. Animals 11 and 12 were sacrificed 3 months after the second operation. Both were in fair condition generally and anemia was not marked (Fig 8, dog 12).

SUMMARY

The cause of death in the first 3 dogs was indisputably peritonitis. The peritoneal infection was believed to be the result of faulty closure of the anastomosis at the time of operation. The

experience in these 3 animals brought several important details in the procedure to our attention, it emphasized the need of meticulous care in the construction of the anastomosis. It was realized that to the usual difficulties encountered in obtaining a union between two segments of the gastrointestinal tract, another was added—that of the motion of respiration to which the parts involved in this union are subjected. Also the wall of the esophagus lends itself less well to suturing than other portions of the alimentary tract. The first layer of sutures, or, the foundation for the posterior wall of the anastomosis is constructed during the first stage operation when intestine, diaphragm, and esophagus are united. This union is secure at the time of the second operation and is further reinforced by a continuous lock stitch placed through the entire wall of jejunum and esophagus after the stoma has been made. The anterior wall of the anastomosis, however, must be constructed entirely during the second stage operation; therefore, meticulous care must be exercised in uniting the walls of jejunum and esophagus anteriorly. The mattress sutures alone cannot be depended upon to make the closure secure; they must be reinforced with interrupted silk sutures. The material employed should be of small caliber and the sutures should pass through the muscularis only and not through the mucosal layer of the organs. Also, the sutures must not be tied too tight, blanching of the wall of the esophagus indicates that the tension on the sutures as tied, is too great.

The anemia which many of the dogs exhibited, has not been studied nor has the cause of the anemia been determined.

EXPERIENCES OF A BLOOD TRANSFUSION TEAM

ROBERT R. BATES, M.D., Chicago, Illinois

SHORTLY after Passavant Memorial Hospital opened in June, 1929, it was appreciated that a permanent team was desirable to obtain efficient blood transfusions with maximum safety. This was the first and, so far as is known, the only hospital in the Chicago metropolitan area to organize a transfusion team, and all but a dozen odd transfusions have been given by it. As experience has accumulated, improvements in the technique have made it possible for succeeding transfusions to be given on shorter notice, more safely, and with less discomfort to both patient and donor.

The team consists of a chief (the surgical fellow) together with the surgical residents. When a transfusion is desired, the attending physician informs his interne, who then consults with one of the team as to a desirable time to do the transfusion. The interne collects cells and serum for typing and cross matching from the patient and the prospective donors. This typing is conducted by the technicians in the hospital's clinical laboratory, except during the night and on week ends, and then it becomes the responsibility of the transfusion chief.

Routinely the hanging drop technique is used, and in only a very occasional case does the titer of one of the blood samples make the typing questionable. In such a case another donor is sought. The hanging drop is allowed to stand one hour at room temperature before being read, unless there is need of unusual speed in giving the transfusion. In such a case several things may be done. The typing may be speeded by placing the slide in an incubator at 37 degrees C for 20 minutes, or, upon being set up, it may be agitated between the fingers for 3 minutes and then read. If agglutination is going to occur, it will be grossly evident within this time. Cross matching is in variably done.

A blood Wassermann test is required on all donors, and emergency Kahn tests may be obtained in an hour's time between the hours of 9:00 a.m. and 3:00 p.m. An adequate list of professional donors of all types, who have had recent Wassermann tests, is kept on file. A large majority of these men attend the medical school and,

therefore, live in the neighborhood. To facilitate paying them promptly, a transfusion fund has been set up by charging \$50 for 500 cubic centimeters of blood and setting aside \$10 before paying \$40 to the donor. Impoverished patients needing professional donors utilize this fund, as do professional donors who stand by but are not used, the latter being paid \$5 for waiting. Furthermore, professional donors for non charity patients are immediately paid from the fund rather than being required to wait until the patient settles his bill. There is never occasion, regardless of the emergency, to utilize a donor whose Wassermann or Kahn has not been tested, since it is the policy in such a case to pay for a professional donor out of the fund rather than take the chance of using a syphilitic donor.

From the time the hospital opened in June, 1929, to January, 1936, a total of 306 patients were given 525 transfusions, an average of 1.7 per patient.

During the first year, the Scannell method was used almost entirely. It was gradually replaced by the citrate method, first, as described by Lewisohn, and, more recently, as a closed system.¹ The multiple syringe method has been used twice, and re-infusion of blood collected at the operation has been done twice. The Lewisohn citrate apparatus consisted essentially of a sterile graduate, placed lower than the donor's arm, into which sodium citrate was poured while the blood was allowed to flow in. A glass stirring rod was used. For the recipient this blood was filtered through gauze and delivered through a salvarsan apparatus. With sterile operating room technique and an assistant, it usually took an hour and a half (depending upon the rate of flow into the recipient) to give a transfusion. The currently used closed citrate system permits much greater convenience and speed and an assistant is not required. Usually within 10 minutes from the time a donor presents himself the blood is flowing into the patient's vein. On one occasion when two operative patients went into shock at the same time both had their transfusions under way within 20 minutes.

It is necessary only occasionally, perhaps once in fifty times, to cut down on a vein on either donor or recipient since small needles, Nos. 16,

¹From the Division of Surgery of Northwestern University Medical School and Passavant Memorial Hospital. Now located at Joliet, Illinois.

²Transfusion of citrated blood. J. Am. M. Ass. 1937 108 553.

TABLE I—TYPES OF PATIENTS

Type (Moss)		Passavant Memorial Hospital	Moss %
IV	(O)	48 1	43
II	(A)	37 8	40
III	(B)	11 7	7
I	(AB)	2 4	10

18 or 20, are used. However, should this be necessary, a fully equipped vein cannulating tray is always available. Experience has shown that a very small median basilic or cubital vein may be enlarged to a satisfactory degree by tapping the vein briskly or placing the arm in warm water. Many times the saphenous at the ankle can be punctured without sacrificing it, and it can always be cannulated. Rarely the jugular has been employed when all other veins have been either thrombosed or ligated, and in male patients the corpus cavernosum is always available for puncture. This is a harmless procedure and efficient if care is taken not to injure the dorsal artery or the urethra.

An analysis of the types of patients transfused indicates that these 306 correspond quite closely with the figures given as a normal proportion of types by Moss (Table I). Not included were 22 patients whose type was not determined since only cross matching was done in those first few months in 1929 before the transfusion team could be organized. It was not possible to associate certain diseases with special blood types. For instance, there was no undue preponderance of carcinoma or any of the blood dyscrasias in a particular blood group.

A word about the effect of transfusion on donors is not out of place. The largest quantity taken at one time from one man was 900 cubic centimeters and this was without undue effect on him. Now and then a donor faints during a transfusion or on regaining his feet if he gets up too soon, and often as not this accident involves the huskier type of person. The routine precaution consists in having him remain prone for 15 minutes, then giving him a full glass of milk, water, or other liquid. Most donors feel weak for 24 hours. Within a few hours they have regained their circulating fluid balance, after 3 weeks they have regained their red cells, and, if they have given many transfusions, their red count regains an abnormally high level. This repeated depletion of red cells stimulates the hemopoietic system to compensate by over production.

One of the most important things to look into in reviewing a series of blood transfusions is not the technique of the procedure (because that may

TABLE II—CORRELATION OF INDICATIONS AND RESULTS IN TRANSFUSIONS

Total	Indications	Results	
		Im proved	Unimproved or died
3	Purpura hemorrhagica hemophilia pernicious anemia	3	0
80	Acute hemorrhage or shock	70	10
53	Marked secondary anemia due to chronic hemorrhage pre-operative major surgery and postoperative general support	49	6
18	Jaundice (for hemostasis)	24	4
36	Septic fever or anemia due to infection	25	11
9	Provide hemoglobin in pneumonia	5	4
33	Peritonitis or postoperative ileus	18	20
31	General support for debility profound toxemia cachexia of cancer uremia	10	21
10	Leucemias	3	7
4	Splenic anemia	1	3
5	Agranulocytic angina	1	4
1	Hodgkin's disease	0	1
7	Septicemia (positive blood culture)	0	7
32	In extremis other than due to shock or hemorrhage	0	32
3	Not evident	0	3

vary with the experience of the operator, and with local conditions) but rather the indications for which transfusion is done. Table II has been compiled to correlate indications with results. In this table those transfusions followed by the most satisfactory results are listed first and, in order, those achieving less and less benefit, until at the bottom one sees that there were 32 cases of patients in *extremis*, not due to shock or hemorrhage, in which transfusion was ordered as something to do as a last resort. None of this latter group was helped.

Figures indicate the number of patients transfused—not the number of transfusions given since all patients were presumably given as many as thought indicated to achieve a good result.

It is evident that transfusion is specific for acute hemorrhage and shock. Because in 10 cases in 80 the patients were not improved is no reflection upon the treatment. Those patients were all past any possible hope of recovery. In marked secondary anemia due to chronic hemorrhage the incidence of definite improvement following transfusion was greater than in those transfusions done for secondary anemia with infection, yet even in the latter category two-thirds of the patients were helped. Adequate pre operative preparation by

transfusion of jaundiced patients having common duct obstruction due either to stone or carcinoma was clearly valuable. Only 4 of 28 such cases bled after operation, and that is in marked contrast to the high proportion of hemorrhages that have occurred in the years before transfusions were done before operation in jaundiced patients. Transfusion was of moderate value in peritonitis and postoperative ileus. One-third of a group of profoundly toxic and cachectic or debilitated patients was improved—a fair record for any kind of therapy against such odds. In contrast, transfusion was of questionable value for the leucemias, and probably of little value in splenic anemia, Hodgkin's disease, and agranulocytic angina. None of the 7 patients with septicemia (proved by positive blood cultures) was in any way aided. The experience of others as reported in the literature is about the same.¹ In contrast to these, one case each of purpura hemorrhagica, hemophilia, and pernicious anemia was clearly benefited. Transfusions given to add hemoglobin to anoxic pneumonia patients were frequently worth while in that, when given in association with oxygen therapy, a marked and prompt fall in respiration and pulse rates, and even temperature, occurred almost as a rule. In general, from Table II, it is seen that about one third of the patients received no appreciable benefit from transfusion. Perhaps a more rigid adherence to the proper indications for giving them would lower this figure.

Allowing for time to correct the water balance, an average gain of about 350,000 red cells may be expected from a 500 cubic centimeter transfusion. Estimates on the life of these red cells vary with different investigators between 2 weeks and 3 months, the work being made more difficult because some of the cells at any given time have reached the end of their normal life period while others are just beginning. One method of approach to this problem consists in transfusing type IV (Moss, or type O Landsteiner) cells into an experimental patient of another type and at intervals agglutinating blood samples with type IV serum, then making blood counts on the non-agglutinated cells.

As would be expected, the prognosis in cases in which patients require multiple transfusions becomes worse roughly in proportion to the number of these transfusions, since the sicker the patient is the more transfusions he may need (Table III).

¹In fact Lewisohn states (J. Am. M. Ass. 1923, 80, 248). The most formidable chills were encountered when treating leucemia and acute sepsis. Experience has shown that in leucemia as well as in acute sepsis, transfusion is useless as a therapeutic measure and sometimes causes grave danger to the patient. For this reason blood transfusion is strictly contra indicated in these conditions.

TABLE III

Cases	Transfusions each	Improved %
196	1	62
58	2	50
20	3	40
7	4	86
4	5	50
3	6	33½
2	7	0
3	8	0
1	13	0

A study of reactions shows that they became progressively less and less frequent from year to year. There were 35 per cent reactions in the last 100 cases, whereas the average for the whole time was 16.7 per cent. Rather rigid criteria were employed in defining a reaction.

The most frequent kind, a slight chill and pulse elevation of at least 15 points, with or without fever, usually coming on one half hour after transfusion and persisting about three quarters of an hour, occurred 52 times. A violent reaction of the same kind with a temperature of over 1½ degrees occurred 12 times. A delayed reaction, by which is meant a chill and 1½ degrees of fever coming on more than 12 hours later, occurred twice. Urticaria, with or without a chill, usually coming on immediately after a transfusion and lasting from 1 to 2 hours, appeared 6 times. Headache, nausea, vomiting, and abdominal cramps, coming on during the transfusion, occurred 4 times. Hemoptysis, dyspnea, and cyanosis, appearing during or immediately after the transfusion, occurred 5 times. In 2 patients the transfusion was followed by congestive heart failure, and death occurred in 6.

1. A 38 year old woman with a liver abscess was transfused because of a secondary anemia of 3,400,000. Her type was III, and 500 cubic centimeters of type IV (Moss) donor blood resulted in a prompt severe cyanosis and was followed by death in 2 hours.

2. A 40 year old woman, with blood pressure 108/138, an ablatio placenta, having 2,300,000 type IV cells was treated for acute hemorrhage with 500 cubic centimeters of type IV blood given by the Scanell method in 27 minutes. When 300 cubic centimeters had been given the pulse was 80 when 500 cubic centimeters was given it was irregular, and 20 minutes later she was dead.

3. A 20 year old girl with agranulocytic angina of 12 hours' duration, having a white count of 600 and no polymorphonuclears, was transfused without incident or benefit. The next day transfusion was repeated, 300 cubic centimeters of citrated blood being given in 13 minutes at which time marked dyspnea appeared. The patient went into circulatory collapse, becoming cold, blue, and almost pulseless and death followed shortly.

4. A 13 year old girl, profoundly septic, with an acute mastoiditis and streptococcus meningitis, was given 350 cubic centimeters of blood in 20 minutes by the multiple syringe method and the transfusion was stopped because of sudden cardiac irregularity. Death followed in 5 hours.

5 A 76 year old man submitted to a transurethral prostatectomy and was transfused after operation because of anemia and a blood pressure of 90/70. During the transfusion of 500 cubic centimeters of citrated blood given over an unknown period of time there occurred sudden chest pain, dyspnea and cyanosis. Pulmonary thrombosis was found postmortem.

6 A 38 year old housewife eviscerating after hysterectomy was repaired and then transfused during one half hour with 500 cubic centimeters of citrated blood. An hour later she became cyanosed, pulse was imperceptible and death promptly followed.

There are several unsettled points as to the etiology of these reactions. From the standpoint of technique the Scannell whole blood method was used 71 times and there were 36 per cent reactions. The citrate method was used 451 times with only 13.8 per cent reactions. The multiple syringe method was used twice, and a reaction occurred once. Reinfusion of blood collected at operation was done twice with no reaction resulting.

In considering the role of blood groups in the etiology of reactions, there were found 9 cases of types II, III, and I recipients who were given blood from type IV, so called universal, donors. 4 reactions occurred. These universal donors were used as such during the earliest days of the transfusion team, before a card catalogue of donors was available. Since then, type IV donors have not been used for other than type IV patients. It has been said that more reactions are likely in type II because of the frequency of subgroups in that type and that it is safer to use type IV than type II donors for those cases. Our records do not substantiate this view. Upon analyzing the reactions we found

Type IV responsible for 39 per cent of the reactions
Type II responsible for 34 per cent of the reactions
Type III responsible for 12 per cent of the reactions
Type I responsible for 7 per cent of the reactions
Types not grouped responsible for 8 per cent of the reactions

This is approximately the proportion of the groupings seen in the total cases.

The time element in giving transfusions is often held to be an important factor in the production of reactions. Records are not complete on the time interval of all transfusions given, but 50 cases having reactions and 50 not having reactions have been analyzed. In the 50 cases with reaction

In 50 cases without reaction

Donor—average time 9.4 minutes
maximum time 40 minutes
minimum time 2 minutes

Recipient—average time 47.5 minutes
maximum time 270 minutes
minimum time 9 minutes

In the transfusions not associated with reactions the donor time was definitely shorter and the recipient's time was nearly twice as long as in the contrasting group having reactions. Although there is no clear evidence that a rapidly given transfusion adds to the frequency of the ordinary chill and fever type of reaction—it does tend to crowd the right heart. Several of the 6 deaths here reviewed were associated with a rapidly given transfusion and were followed by circulatory failure. In addition, there were 2 cases in which patients developed prompt congestive heart failure and lived. In these, the transfusions took 13 and 20 minutes, respectively.

In looking further into the cause of reactions, since in all but 1 of these cases proper cross matching was done, it seems likely that sterile but chemically unclean apparatus may account for most of the cases developing moderate chills and fever. This last year, since using only distilled water to clean both transfusion and intravenous sets, chills and fever have become a rare occurrence. No doubt the high incidence of reactions in using the Scannell apparatus was due to the difficulty in cleaning this relatively complicated mechanism. Protein sensitivity must account for many of the reactions characterized by headache, nausea, vomiting, and urticaria.¹ Hemoptysis, dyspnea, and cyanosis, usually coming on during the transfusion, seem most likely the manifestations of multiple small emboli or, as was proved in 1 case, a large pulmonary embolus. These usually occurred in elderly people.

In several cases coming to postmortem examination the pathologist on finding deposits of hemoglobin in the glomeruli has asked if the patient had had a recent transfusion. In an effort to associate reactions with renal pathology, 40 cases having a negative urine sediment before transfusion were followed for several days with check urines. In many of these a small amount of albumin, hyaline, and granular casts appeared.

Quoting Vaughan and Pipes: "On the Probable Frequency of Allergic Shock." in the *American Journal of Digestive Diseases and Nutrition*, 1936, 3, No. 8, Oct. The recipient was allergic to egg. The donor gave eggs about 3 hours before transfusion. After receiving 75 cubic centimeters of blood the recipient experienced severe dyspnea. He had placed in an oxygen tent and given adrenalin with recovery. He had previously had eczema but had never had asthma. Direct blood matching and by groups had shown compatibility prior to transfusion.

Donor—average time 13.5 minutes
maximum time 75 minutes
minimum time 5 minutes

Recipient—average time 21.7 minutes
maximum time 50 minutes
minimum time 6 minutes

and persisted for from 2 to 8 days, but they were not found any more frequently in those patients who had reactions than in those who did not have them

The more common type of reactions with chills and fever are best treated prophylactically by using clean apparatus. The clots and blood in a recently used transfusion set are immediately washed out with double distilled water under pressure rather than using tap water. Since this has been carefully done this type of reaction has become relatively rare—much less frequent in fact than is shown by the figures in this study which extend only up to the beginning of 1936. Actual treatment consists only in supplying adequate blankets and hot water bottles and reassuring the patient that the discomfort is harmless and short lasting. The itching of urticaria, by contrast, is most satisfactorily treated with adrenalin given as early as possible. That type of reaction characterized by headache, nausea, vomiting, and cramps calls for immediate interruption of the transfusion, and, since a small amount of incompatible blood can cause it, the first 20 cubic centimeters should be given slowly. Hemoptysis, dyspnea, and cyanosis should have the same type of treatment with the addition of oxygen. If incompatible blood should have been given through error—a prompt transfusion with matched blood may be life saving.

Several theses are offered—not to be taken as facts but rather as convictions arising from the experience of the transfusion team

1 The matter of whether or not sodium citrate is injected intravenously plays no direct part in the etiology of reactions

2 Sodium citrate in no way affects the bleeding or clotting time of the patient since enough calcium is always available to neutralize it. A citrate transfusion is as valuable for jaundiced patients as is whole blood

3 Blood given rapidly to a recipient does not increase the chances of reaction—exception cases of impending circulatory embarrassment should be protected by a slow transfusion. Most of our serious accidents occurred by minimizing this point

4 A previous recent transfusion does not make more likely a reaction to a subsequent transfusion from a different donor

5 Aside from not being definitely helped, leucemia, agranulocytic angina, subacute bacterial endocarditis, and splenic anemia cases suffer a high incidence of reactions

6 Patients *in extremis* not due to shock or hemorrhage should not be transfused. In 32 of these cases patients were transfused in spite of the fact that not one of them has ever been helped. It should be pointed out that as a gesture transfusions, besides often being expensive, are not free from danger to the patient if not deleterious to the donor, i.e., 16.7 per cent of the patients had reactions. Ten of them were severe enough to require stopping the transfusion, 6 others ended fatally under circumstances which involved the transfusion as a major etiological factor

EDITORIALS

SURGERY

Gynecology and Obstetrics

FRANKLIN H. MARTIN, M.D.
Founder and Managing Editor
1903-1935

ALLEN B. KANAVEL, EDITOR

Associates

LOYAL DAVIS

SUMNER L. KOCH

MICHAEL L. MASON

DONALD C. BALFOUR *Associate Editorial Staff*

OCTOBER 1937

ACUTE CHOLECYSTITIS — WHY DELAY?

A CYNIC once inquired, "Was life worth living?" and received the captious reply, "It all depends on the liver."

All experimental animals with an Eck's fistula die of septicemia and the interposition of the liver between the alimentary system with its portal connections and the general arterial system indicates the primal importance of the liver in protecting the individual from systemic infection. A continuous debate and many publications would seem to indicate that the question when to operate in acute cholecystitis is still undetermined. It has been demonstrated that, in acute infections of the gall bladder, there are varying degrees of pathological change in the common duct, pancreas, and liver, and recent papers on acute cholecystitis indicate that the gall bladder is either gangrenous or has perforated in over 20 per cent of the patients subjected to surgical intervention. It has

been held that the operative mortality in acute cholecystitis is prohibitive and that this mortality may be lessened by a resting period of watchful waiting. It would seem that this thesis is based upon rather dubious premises. When an acute infection starts in the gall bladder complicated, as it usually is, by the presence of foreign body—calculi—the pathological sequence is that of a progressive inflammatory invasion. The viscus becomes infiltrated with polymorphonuclear and round cells, marked inflammatory edema ensues, pressure changes follow, and some degree of infection occurs in the lymphatics of the liver and pancreas. All of these elements are certainly present.

It would appear to be very definitely settled that there is no parallelism between the clinical symptoms of acute cholecystitis and the pathological damage present in the gall bladder. Numerous authors have observed that all too frequently clinical manifestations of the disease are subsiding while the gall bladder is progressing to empyema, gangrene, and perforation. Zininger reports 54 cases of acute cholecystitis which were kept under observation from 1 to 12 days. In 37 per cent the attacks subsided, while in 35 per cent the attacks failed to subside after an interval of 12 days. In 27 per cent the attacks not only failed to subside but became progressively worse and four perforations of the gall bladder were found at operation. It follows from these observations that a patient with an acute cholecystitis has one chance in three of having a resolution of the pathological process in the gall bladder.

The early history of appendicitis was clouded by similar controversial discussions as to when and when not to operate. For the

physician to counsel waiting in acute disease is to participate in a surgical gamble that "under a regimen of starvation, local applications, an ascending phase of pathological change will become arrested" This is distinctly a gamble with the odds against him The records of patients so treated show that while nature may "wall off" the gall bladder the primary and essential lesion is, in over 63 per cent of cases, a continuing process leading to grave surgical complications

Few individuals will long withstand the disseminating effects of the retention of the products of infection under pressure and the technical indication for operation in acute cholecystitis is to institute drainage, so that the products of infection will not be retained under pressure, hence gangrene and perforation will be forestalled Operation provides a means of overcoming the increasing peril of undrained infection It is not necessary to advocate cholecystectomy or any one set form of operation The indication is to operate carefully, with due celerity, relieve the mechanical obstruction, and provide drainage This may be done by a simple cholecystectomy, by marsupialization of the fundus of the gall bladder, or by splitting the gall bladder from the fundus to the cystic duct and enucleating the mucous membrane of the gall bladder, performing an intravesical cholecystectomy with drainage By any one of these procedures drainage is provided, yet the protective barrier around the gall bladder and particularly that protection interposed between the liver and the gall bladder is left undisturbed Few will countenance the classical cholecystectomy with the opening up of the large liver bed of the gall bladder fossa, thus exposing a relatively wide area to septic absorption and destroying the natural barrier of resistance that has been built up Most of the cases of acute cholecystitis are super-

imposed upon chronic cholecystitis and usually with the complicating factor of calculus Preventive medical thought and wise, judicious surgery would suggest the early removal of the chronically infected gall bladder and not delay until the accident of infection initiates a fulminating acute cholecystitis If infection is the primary and basic danger in acute gall-bladder disease then the continuation of the infection by a policy of "innocuous desuetude" is harmful and lethal and any properly collected series of cases will show a higher mortality with this policy than that which accompanies early surgical intervention

Teachers of surgery who lend their prestige and give support to a policy of waiting provide authority for timid surgeons, inexperienced operators, and procrastinating practitioners Increasing statistics demonstrate forcibly that the operative mortality in patients who are operated upon in the early stage of acute cholecystitis is not greater than that which obtains in routine gall-bladder surgery Furthermore, the high mortality, of approximately 20 per cent that occurs after late operation is largely the mortality that arises from the complications—empyema, abscess, gangrene, and perforation—and, when and if operative recovery finally takes place, there remains the permanent damage to liver and associated organs with continued morbidity

CHARLES GORDON HEYD

GASTRO-INTESTINAL HEMORRHAGE

THE great variability in reports on the mortality from hemorrhage associated with ulcer is partly owing to the classification of the cases It may be assumed, however, that in any case in which hospitalization is required for gastro-intestinal

hemorrhage, the hemorrhage can be looked on as at least moderately severe. In a recent article, Reschke stated that the mortality in a group of cases in which the hemorrhage was so classified was 9.5 per cent and that among those cases in which the hemorrhage was considered to be severe, the mortality varied in different clinics from 17 to 27 per cent. In the face of such statistics, the possibilities of surgical treatment of acute hemorrhage would seem to merit consideration. There is, however, not only the problem of selecting for operation those cases in which there would otherwise be a fatal outcome, but there is also the fact that reports from clinics other than that with which Reschke's report was concerned do not indicate any such mortality as that reported by him among patients who are hospitalized because of gastro intestinal hemorrhage and who are treated non surgically. One of the most interesting studies, for example has been that of Meulengracht who showed that the mortality among patients admitted to hospital and treated non surgically because of hemorrhage from ulcer is very much lower (4.1 per cent) than that reported from other clinics and also that an adequate intake of food, immediately instituted, reduced the mortality to 1 per cent in a series of approximately 300 cases. Subsequent studies of Meulengracht's group of cases as compared with those in which routine treatment consisting of rest and abstinence from food was employed, have shown that the blood picture in his cases returned much more rapidly to normal.

Further in support of the contention that hemorrhage from peptic ulcer is not considered in actual percentage, often likely to result fatally, Hurst and Ryle have reported a mortality of 1.5 per cent attributable to hemorrhage from ulcer among patients encountered in general practice, and a mortality of 4.8 per

cent among patients with ulcer admitted to hospital because of hemorrhage.

Hurst and Ryle have stated that there are three outstanding difficulties in the management in severe cases: "(1) the difficulty of giving a prognosis even when we know something of the nature, site, and size of the lesion, and can gauge the amount and continuance of the blood loss, (2) the difficulty of refraining from active interference because we possess this knowledge and because we are anxious, and (3) the difficulty in many instances of being sure whether there is a demonstrable ulcer present at all." It is probably this last difficulty that contributes so much confusion to both the prognosis and treatment of gastrointestinal hemorrhage. There is increasing evidence to substantiate the belief that the majority of hemorrhages which originate in the stomach and duodenum are not the result of excavating ulcers but rather of a diffuse hemorrhagic condition associated with either multiple, superficial ulcerations, or with an inflammatory process that is not attended by even these superficial erosions. Whether, in turn, this inflammatory condition may be dependent on food allergy, or deficiency of vitamin C or a focus of infection is still to be established, but there is much to suggest that many, and perhaps the majority, of these hemorrhages have some basis other than chronic ulcer, and for this group of cases in which chronic ulcer is absent there are as yet no surgical indications.

Of some aid in prognosis in the cases in which chronic ulcer is present is the degree of arterial change. Hesser has shown that the mortality among the younger patients is definitely lower than it is among those who are of the age in which some degree of arterial sclerosis is common. He cited his own figures which furnish striking evidence to support this fact. In a group of 195 patients who were

less than 55 years of age there was no fatality, and in a group of 109 patients who were more than 55 years of age there were 9 fatalities

The most significant evidence of a possibly fatal outcome is a fresh, massive hemorrhage occurring while a patient is under treatment for hemorrhage, and it is then that operation can be justifiably considered even though it is not positively known that the patient has an ulcer. Under such circumstances, a massive transfusion of blood, or a continuous transfusion over a period of several hours, should be given, together with the best surgical procedure which is possible. Selection of this procedure is not necessarily made on the same basis as in the case of chronic ulcer, for the reason that the chief purpose of the operation is to avert death from hemorrhage. Theoretically, anything short of direct attack on the ulcer should not be considered effective surgery and therefore indirect operations in such cases should not be of much benefit. To what extent complete exclusion of a lesion in which bleeding is taking place from an eroded vessel will contribute to satisfactory clotting is problematical, but it is significant that those who advocate partial gastrectomy for bleeding duodenal lesions during the time of hemorrhage are also advocates of the exclusion type of resection when excision of the lesion appears to be a too difficult and hazardous procedure. If exclusion of the lesion is effective in arresting the hemorrhage in the region of the lesion,

temporary exclusion combined with gastro-enterostomy should serve the same purpose in so far as control of bleeding is concerned. From a theoretical standpoint, probably the best surgical procedure for a penetrating ulcer which is the site of hemorrhage is to open the stomach or duodenum widely near the lesion so that the crater can be visualized and to excise enough of the lesion, either by cautery or scissors, so that the tissues can be approximated by deep, continuous, catgut suture, and to combine this with some operation, either reconstruction of the outlet of the stomach, or gastro-enterostomy, or partial gastrectomy, to modify gastric function sufficiently to give as good prospect as possible for the prevention of further ulceration.

The present status of the management of acute hemorrhage from the stomach or duodenum, therefore, may be summarized by saying that until there is some more definite means than are available now of recognizing the small percentage of patients who will succumb to the hemorrhage, any attempt to employ surgical measures in other than those cases in which an obviously severe recurrence of bleeding takes place while the patient is under treatment for hemorrhage, will result in unnecessary deaths, and in sufficient number that the mortality in hemorrhagic ulcer will be higher under surgical treatment than it will be under medical management.

DONALD C. BALFOUR

MASTER SURGEONS OF AMERICA

LEONARD FREEMAN

ON December 27, 1935, Dr Leonard Freeman, then 75 years of age, died of coronary thrombosis at his home in Denver, Colorado. A long, active, and productive professional career was closed after an illness of but a few days.

Dr Freeman, the son of Dr Zoeth Freeman and Ellen Ricker Freeman, was born in Pine Grove, Ohio, on December 16, 1860. He received his primary education in private schools and was graduated from the University of Cincinnati with a B S degree in 1882, and from the Medical College of Ohio in 1885. He served 1 year as interne in the Cincinnati Hospital. The next 3 years he spent abroad at the University of Goettingen. He studied pathology under Virchow and bacteriology under Koch. He then pursued postgraduate clinical work in Berlin and Vienna.

Returning to Cincinnati he taught pathology and bacteriology in the Ohio Medical College and served as pathologist and bacteriologist in Cincinnati Hospital from 1889 to 1891. During these years he was associated with Dr Phineas Connor, then one of the ranking surgeons of the United States.

In 1891 his health broke and he went to Colorado. Regaining his health he took a sea voyage on a sailing vessel to Honolulu. While in the Hawaiian Islands he spent some time in the Leper Colony at Molokai.

In 1894 he married Miss Amanda Frank of Cincinnati and in 1895 returned to Denver, Colorado, to live. They had three sons: Frank, the eldest, an engineer living in Denver, Paul, who died in 1917, and Leonard, Jr., a surgeon who was associated with his father. His first wife died in 1904. In 1906 he married Miss Jean Wright of Denver who with his two sons survive him.

Dr Freeman became a member of the Gross Medical College of Denver in 1897.

From the day of his graduation from Medical College up to the day of the onset of his brief but fatal illness he assiduously studied and impressively taught practical surgery. Dr Freeman was of vigorous and powerful physique, possessed of the spirit and determination of the true pioneer. Cast in a big mold, bigness was expressed in his every thought and deed. Unostentatious, guileless, devoid of pettiness, he could not comprehend the absence of these qualities in others,



LEONARD FREEMAN
1860-1935

therefore he was frequently imposed upon by those less sincere. He was the personification of honesty, the soul of honor and justice, aggressive and courageous, a staunch defender of the weak, and a champion of the righteous.

Dr Freeman was an ardent student of primitive, as well as contemporaneous, surgery both foreign and American. Blessed with an analytical mind and an unflinching memory and with his splendid early training in pathology and bacteriology it was but natural that he became, and for many years was, one of America's outstanding resourceful surgeons. He was a clear and logical thinker and a forceful terse speaker. What he said or whatever he did was based upon knowledge and personal experience. In his studies, writing, teaching, consultation, operations, and discussions, he demonstrated an almost superhuman faculty of grasping essentials. He faced facts. He was authority.

In his early years he was interested in archeology. He studied ornithology with Charles Drury, a prominent naturalist of Cincinnati.

Dr Freeman was a world traveler. On numerous journeys through Europe, Central and South America, on voyages to Japan, China, the Philippine and South Sea Islands, he never failed to study the hospitals, the surgery and surgeons of these often remote countries. He availed himself of every opportunity to delve into primitive and aboriginal surgery. These studies resulted in several important papers on the subject. Dr Freeman's contributions to surgical literature were of wide range, numerous, and valuable.

He was a member and an ex-president and very consistent attendant and contributor of the Denver Clinical and Pathological Society, the Medical Society of the City and County of Denver, the Colorado State Medical Society, and the Western Surgical Association. He was an enthusiastic member of the American Surgical Association, the Société Internationale de Chirurgie and the American College of Surgeons.

The high regard with which Dr Freeman was held throughout the West is evidence of his excellent surgery and his stimulating influence on a vast number of students and the younger members of the profession. Dr Leonard Freeman is dead but the memory of so great a surgeon, so inspiring a teacher, so true a man and such a loyal friend can not die.

C F HEGNER

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

EVERY general surgeon is familiar with the earlier editions of Horsley's *Operative Surgery*,¹ three editions of which appeared from 1921 to 1928 a fourth edition written in co authorship with Isaac A. Bigger professor of surgery of the Medical College of Virginia has been published in two volumes. In the second and third editions minor changes were made by adding descriptions of new technical procedures as they became incorporated into standard surgical practice. These early editions were written entirely by Dr. Horsley, a general surgeon working however in the entire domain of surgery. His writings were based on his own experience except in certain fields of specialization where he relied on his judgment rather than his experience. His interests were largely in the field of abdominal surgery consequently this subject was more completely and authoritatively covered whereas the other specialties were handled according to his familiarity with those fields of special endeavor.

The first popular textbooks on operative surgery since the beginning of modern surgery had been written with sole emphasis upon the anatomical features of operations later some authors added the developing knowledge of surgical pathology while Horsley marked the growing union of surgery with physiology and the other biological sciences by writing his book on operative surgery with stress on physiological principles and biological processes. These principles are now firmly fixed in surgical practice. In this fourth edition there is a radical change in the character and scope of the work. This change signifies an appreciation of the fact that surgery has become too large a subject for one man to master. Advances in knowledge in the special fields are made by those working intimately in those fields and what was formerly called general surgery has now become a surgical specialty with boundaries as circumscribed as those of other surgical specialties.

In addition to Professor Bigger, Dr. Horsley has as collaborators a group of men eminent in the surgical specialties from the faculty of the Medical College of Virginia. The work now describes more completely the operative procedures of the surgical specialties and its issuance in two volumes adds greatly to the convenience of the reader.

Horsley writes as before on subjects that fall under the general principles of surgery and on the operative procedures in surgery of the abdomen. Bigger is responsible for the chapters on surgery of the neck,

thorax, breast, hernia sympathetic nervous system and part of the operations on the extremities. There are sections on neurological surgery by Dr. C. C. Coleman, on urology by Dr. A. I. Dod, on orthopedic surgery by Dr. Donald M. Faulkner, and on plastic surgery by Dr. John S. Horsley, Jr.

The new contributors have used the same pleasing readable narrative style so successfully followed in the previous editions. Fortunately the step descriptions of surgical procedures in which operations were done to the count of the drill master have largely disappeared from surgical literature. The informal approach used aided by profuse illustrations gives a much more accurate and vivid feel of the operating room. The illustrations, largely by Miss Helen Lorraine have been increased by about 500 in number and their uniform excellence and accuracy add tremendously to the clarity of the technical descriptions. There has been a tendency in medical publications to carry along for years obsolete practices and procedures but this work gives the impression of having started from scratch with the subject matter giving a sense of freshness unusual in fourth editions.

The chapters on the surgery of the abdomen by Horsley have been amplified and brought fully up to date. His views on peptic ulcer based on physiological reasoning continue to be of the more conservative nature largely held today by American surgeons. He rides no hobbies and presents the subject as a master of it. The new chapters on the surgery of the thorax by Bigger are wisely introduced by a rather comprehensive discussion of the anatomy and physiology of the chest while the operations described have been carefully selected from the many new technical procedures developed in late years in this latest of the surgical specialties. The chapters on urology neurological surgery and orthopedic and plastic surgery are carefully done and while it is a difficult problem to decide just what the limitations of such presentations should be, the selection of subject matter has been skillfully made. Obviously a short presentation in a chapter is not adequate to guide the surgeon wishing to become a specialist in any one of these narrow fields. But these subjects have been handled so as to be of great value to the man desiring knowledge of surgical technique in these fields. The time has not yet come when all surgery in special fields can be done by masters in them and guides to these procedures are imperative for surgeons who must still cover the wide surgical domain.

A book on operative surgery cannot be expected adequately to cover every phase of the pre-operative and postoperative care of the patient but something

¹OPERATIVE SURGERY. By J. Shelton Horsley M.D. LL.D. F.A.C.S. and Isaac A. Bigger M.D. Vols. 1 and 2 4th ed. St. Louis C.V. Mosby Co. 1937.

of this important subject is well given in the discussion of fundamental surgical principles. The young surgeon, however, will be obliged to supplement this phase of his work by reading elsewhere. The work should be a popular one as it is suitable for training the surgical interne, and the young surgeon, and forms a valuable addition to the shelves of the mature surgeon. No other work on operative surgery in English gives such a comprehensive and authoritative presentation of the subject as does this one. It will not prove necessary to those who have mastered a specialty but will be of great help to many of us who still must do work in several fields of surgical specialization. The excellent illustrations, pleasing style, and smaller size of the volumes make it attractive to handle and read. The fourth edition of this well known work can be highly recommended to anyone interested in the subject of surgery. The changes have been so great that those who own any of the previous editions must get the new edition. It will be an indispensable work to the young man wishing to become a surgeon.

FREDERICK A COLLIER

A VALUABLE background for that growing personnel of nurses, technicians, and helpers associated with the physician is furnished in Boyd's *An Introduction to Medical Science*.¹ The book de-

¹AN INTRODUCTION TO MEDICAL SCIENCE. By William Boyd M.D. M.R.C.P. (Edin.) F.R.C.P. (Lond.) Dipl. Psych. F.R.S. (Canada). Philadelphia: Lea & Febiger 1937.

scribes in the simplest terms the processes of disease in the various organs and systems of the body.

PAUL STARR

DR OSMAN has caused to be published in modern form a copy of the famous "Reports on Medical Cases Selected with a View of Illustrating the Symptoms and Cure of Disease by a Reference to Morbid Anatomy," published in 1827, together with three other articles by Richard Bright.² The author then presents an appendix of recent histological and radiological observations on the kidneys of three cases of Dr Bright which are in the museum at Guys Hospital where this remarkable original work was done. The colored plates of those original beautiful colored engravings illustrating the different types of renal pathology are well reproduced. Dr Bright's paper which appeared in the first volume of Guys Hospital reports in 1836, which is reproduced in this book, "contains an account of the mode, onset, and clinical course of acute nephritis which has probably never been surpassed." Certainly every student and physician will enjoy and derive great inspiration from reading the observations and the protocols which have been recorded by Dr Bright and which Mr Osman has made available to every one in this recent volume.

M HERBERT BARKER

²OXFORD MEDICAL PUBLICATIONS. ORIGINAL PAPERS OF RICHARD BRIGHT ON RENAL DISEASE. Edited by A. Arnold Osman D.S.C. F.R.C.P. London: Oxford University Press 1937.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE PRACTITIONERS LIBRARY OF MEDICINE AND SURGERY. Vol. 12—PREVENTIVE MEDICINE AND HYGIENE. New York and London: D. Appleton Century Co., 1937.

PATHOLOGY OF THE CENTRAL NERVOUS SYSTEM. By Cyril B. Courville, M.D. Mountain View, California: Pacific Press Publishing Ass., 1937.

THE RABBIT TEST, FOR THE DETECTION OF CHORIONIC TISSUE IN THE BODY AND THE DETERMINATION OF ITS PROLIFERATIVE ACTIVITY. By S. B. Anikshana M.D. (Bom.) With a foreword by Dr. Emil Novak. Bombay: Fort Printing Press, 1937. (Obtainable in Europe or America from H. K. Lewis & Co. Ltd., London.)

DEVELOPMENT OF THE HUMAN SKELETON. Part I—TRUNK AND EXTREMITIES. (Reprinted from an article entitled "An Epiphyseal Chart" by Paul C. Hodges in *Am. J. Roentgenol.* 1933, No. 6, Vol. 30.) Chicago: The University of Chicago Press 1937.

URGENCE DE CHIRURGIE, TABLEAUX CLINIQUES CONDITE A TENTE. By L. Dambrin. Paris: G. Doin & Cie, 1937.

LA THORACOPLASTIE PAR VOIE AXILLAIRE. By F. Ch. Ecot et W. Julien. Paris: G. Doin et Cie, 1937.

PEDIATRIC UROLOGY. By Meredith F. Campbell M.S., M.D. F.A.C.S. With a Section on Bright's Disease in Infancy and Childhood by John D. Lytle, A.B., M.D. Vols. 1 and 2. New York: The Macmillan Co., 1937.

OXFORD MEDICAL PUBLICATIONS. POCKET ATLAS OF ANATOMY. By Victor Pauchet and S. Dupret. 3d ed. New York and London: Oxford University Press 1937.

OBSTETRICS FOR NURSES. By Joseph B. DeLee, A.M., M.D., and Mabel C. Carmon, R.N. 11th rev. ed. Philadelphia and London: W. B. Saunders Co., 1937.

OXFORD MEDICAL PUBLICATIONS. DISEASE AND THE MAN. By Roger F. Lapham, A.B., M.D. New York: Oxford University Press, 1937.

SOME FUNDAMENTAL ASPECTS OF THE CANCER PROBLEM. Edited by Henry Baldwin Ward. Occasional Publications of the American Association for the Advancement of Science. No. 4. June, 1937. Supplement to *Science*, Vol. 85. New York: The Science Press 1937.

OXFORD MEDICAL PUBLICATIONS. A TEXTBOOK OF THE PRACTICE OF MEDICINE. By Various Authors. Edited by Frederick W. Price, M.D. C.M., F.R.C.P., F.R.S. (Edin.) 5th ed. New York and London: Oxford University Press, 1937.

NEUROLOGY. By Roy R. Grinker, M.D., 2d ed. Springfield Ill. and Baltimore, Md.: Charles C. Thomas 1937.

THE THERAPEUTIC PROBLEM IN BOWEL OBSTRUCTIONS. A PHYSIOLOGICAL AND CLINICAL CONSIDERATION. By Owen H. Wangersten, B.A., M.D., Ph.D. Springfield Ill. and Baltimore, Md.: Charles C. Thomas 1937.

MATERNAL DEATHS—THE WAY TO PREVENTION. By Iago Galdston, M.D. New York: The Commonwealth Fund 1937.

COLLECTED PAPERS FROM THE FACULTY OF MEDICINE. OSAKA IMPERIAL UNIVERSITY 1936. Osaka, Japan: Compiled by the University 1937.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL New York *President*

FREDERIC A. BESLEY, Waukegan *President Elect*

VERNON C. DAVID *Chairman* MICHAEL L. MASON, *Secretary, Committee on Arrangements*

PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

CLINICAL CONGRESS PROGRAM IN BRIEF

Monday October 25

- 10 00 Hospital Conference—Grand Ballroom
- 2 00 Clinics in hospitals
- 2 00 Hospital Conference—Grand Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 3 00 Meeting of Initiates—College Auditorium
- 4 00 Reception to Fellows and Initiates—College
- 8 00 Presidential Meeting and Convocation—Grand Ballroom

Tuesday October 26

- 9 00 Clinics in hospitals
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 2 00 Clinics in hospitals
- 2 00 Symposium on Cancer—Grand Ballroom
- 2 00 Hospital Conference—North Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 9 00 Scientific Session General Surgery—Grand Ballroom
- 8 00 Scientific Session Ophthalmology—North Ballroom
- 8 00 Hospital Conference—Boulevard Room

Wednesday October 27

- 9 00 Clinics in hospitals
- 9 30 State and Provincial Judiciary Committees—College Auditorium
- 10 00 State and Provincial Credentials Committees—College Auditorium
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 11 00 State and Provincial Executive Committees—College Auditorium
- 2 00 Clinics in hospitals
- 2 00 Symposium on Graduate Training for Surgery—Grand Ballroom
- 2 00 Symposium on Obstetrics and Gynecology—North Ballroom
- 2 00 Hospital Conference—Grand Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Scientific Session General Surgery—Grand Ballroom

Thursday October 28

- 9 00 Clinics in hospitals
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 1 30 Annual Meeting—Grand Ballroom
- 2 00 Clinics in hospitals
- 2 00 Hospital Conference—North Ballroom
- 3 00 Symposium on Industrial Medicine and Traumatic Surgery—Grand Ballroom
- 3 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Scientific Session General Surgery—Grand Ballroom
- 8 00 Scientific Session Otolaryngology—North Ballroom

Friday October 29

- 9 00 Clinics in hospitals
- 10 00 Surgical Film Exhibition—Boulevard Room
- 2 00 Clinics in hospitals
- 2 00 Fracture Symposium—Grand Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Community Health Meeting—Grand Ballroom

THE surgeons of Chicago, under the leadership of a representative committee have prepared a program of clinics and demonstrations that will provide a complete showing of the clinical activities in all departments of surgery in this great medical center for the twenty seventh annual Clinical Congress of the American College of Surgeons, October 25-29. The Committee is assured of the hearty co-operation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

Published in tentative form in the following pages, the clinical program is to be further revised and amplified during the weeks preceding the Congress. Clinics are scheduled for the afternoon of Monday, October 25 and for the mornings and afternoons of each of the four following days. The final clinical program will be published from day to day during the Congress—a complete detailed program will be posted in the form of bulletins at headquarters at the Stevens Hotel each afternoon for the succeeding day and issued in printed form the following morning.

In addition to an ample and well arranged schedule of operative clinics demonstrating the technique of a wide variety of surgical procedures, the Committee has arranged a series of demonstration clinics at the medical schools and in several of the larger hospitals where the work being done in many special fields will be presented including Neurosurgery, traumatic surgery, thoracic surgery, plastic surgery, fractures, cancer, orthopedics, gynecology and obstetrics, genitourinary surgery, experimental surgery, roentgenology, ophthalmology, otolaryngology, etc.

Also, it is to be noted that the Committee has undertaken to correlate the programs of the participating institutions so that the visiting surgeon may devote his time continuously to clinics dealing particularly with the special subjects in which he is most interested. Thus it has been arranged so that fracture clinics or cancer clinics, for example, will be available each morning and afternoon during the Congress.

EVENING SCIENTIFIC MEETINGS

The Executive Committee of the Board of Regents has prepared programs for a series of evening meetings as published in the following pages. At the *presidential meeting and convocation* on Monday evening in the ballroom of the Stevens Hotel, Dr. Vernon C. David, Chairman of the Committee on Arrangements, will deliver the address of welcome following which a number of distinguished foreign guests will be introduced.

At this session the retiring president, Dr. Eugene H. Pool, of New York, will deliver the presidential address which will be followed by the inauguration of the new officers. Dr. Frederic A. Besley, of Waukegan, president, Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schinbein, of Vancouver, vice presidents. A feature of this evening's program will be the annual College oration on surgery by J. P. Lockhart-Mummery, M.B., B.Ch., F.R.C.S., of London, England. The 1937 class of initiates will be received into fellowship in the College at this session.

Eminent surgeons of the United States and Canada will present papers on surgical subjects of present day importance at sessions in the grand ballroom on Tuesday, Wednesday and Thursday evenings.

On Tuesday and Thursday evenings, in the north ballroom of the Stevens Hotel, eminent surgeons who specialize in the fields of ophthalmology and otolaryngology will present and discuss papers of interest to those whose work is limited to these particular fields.

Following its established custom and in recognition of an obligation to the public to provide authoritative information on modern surgery, better hospitals and the prevention of disease, a community health meeting will be held in the grand ballroom on Friday evening. The program consists of brief, interesting talks on scientific medicine, health and hospitals.

CONVOCATION

Departing from the custom of former years the convocation and the presidential meeting of

the College will be combined in one session to take place at the Stevens Hotel on Monday evening, October 25. This change has been made to enable the initiates to participate in the Congress as fully accredited fellows of the College. At the evening meeting, however, the convocation ceremonies will be confined to the formal conferring of fellowship upon the initiates. Other features of the convocation will take place in the auditorium of the John B. Murphy Memorial Building at 50 East Erie Street on Monday afternoon at 3:00 o'clock. The order of the program follows:

Processional

Address by the President

Addresses by members of the Administrative Board

Recital of the fellowship pledge

Signing of the fellowship roll

Closing remarks by the Chairman, Board of Regents

This meeting will be attended by initiates and fellows (fellowship gown to be worn). It will be followed by a reception by the officers and regents for the fellows and initiates and members of their families in the adjoining administrative building of the American College of Surgeons at 4 o'clock.

AFTERNOON SESSIONS

Five afternoon symposia have been arranged dealing with the following subjects: Cancer, graduate training for surgery, obstetrics and gynecology, industrial medicine and traumatic surgery, and fractures. (Programs appear in following pages.)

On Tuesday afternoon a symposium on cancer, under the auspices of the College Committee on the Treatment of Malignant Diseases, will include discussions of various types of malignant growths occurring in different parts of the body and methods of treating them. As the concluding feature of the session a report on five-year cures supplementing the 24,440 five-year cures reported three years ago, will be presented by Dr. Bowman C. Crowell, head of the Department of Clinical Research of the College.

For Wednesday afternoon a symposium has been planned on a subject in which wide interest has been manifested—graduate training for surgery. General presentation of the subject will be followed by a report of findings of a special field representative of the College in a 1937 survey of hospitals, after which representatives of various surgical groups, and of teaching, large nonteaching, and rural community hospitals will give their viewpoints. Following this a representative of a large clinic will speak on their experiences in

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York *President*

FREDERIC A. BESLEY, Waukegan *President Elect*

VERNON C. DAVID, Chairman MICHAEL L. MASON, *Secretary Committee on Arrangements*

PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

CLINICAL CONGRESS PROGRAM IN BRIEF

Monday, October 5

- 10 00 Hospital Conference—Grand Ballroom
- 00 Clinics in hospitals
- 2 00 Hospital Conference—Grand Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 3 00 Meeting of Initiates—College Auditorium
- 4 00 Reception to Fellows and Initiates—College
- 8 00 Presidential Meeting and Convocation—Grand Ball room

Tuesday, October 6

- 9 00 Clinics in hospitals
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 2 00 Clinics in hospitals
- 2 00 Symposium on Cancer—Grand Ballroom
- 2 00 Hospital Conference—North Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Scientific Session General Surgery—Grand Ballroom
- 8 00 Scientific Session Ophthalmology—North Ballroom
- 8 00 Hospital Conference—Boulevard Room

Wednesday, October 7

- 9 00 Clinics in hospitals
- 9 30 State and Provincial Judiciary Committees—College Auditorium
- 10 00 State and Provincial Credentials Committees—College Auditorium
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 11 00 State and Provincial Executive Committees—College Auditorium
- 2 00 Clinics in hospitals
- 2 00 Symposium on Graduate Training for Surgery—Grand Ballroom
- 2 00 Symposium on Obstetrics and Gynecology—North Ballroom
- 2 00 Hospital Conference—Grand Hospital
- 2 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Scientific Session General Surgery—Grand Ballroom

Thursday, October 8

- 9 00 Clinics in hospitals
- 10 00 Hospital Conference—North Ballroom
- 10 00 Surgical Film Exhibition—Boulevard Room
- 1 30 Annual Meeting—Grand Ballroom
- 2 00 Clinics in hospitals
- 2 00 Hospital Conference—North Ballroom
- 3 00 Symposium on Industrial Medicine and Traumatic Surgery—Grand Ballroom
- 3 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Scientific Session General Surgery—Grand Ballroom
- 8 00 Scientific Session Otolaryngology—North Ballroom

Friday, October 9

- 9 00 Clinics in hospitals
- 10 00 Surgical Film Exhibition—Boulevard Room
- 2 00 Clinics in hospitals
- 2 00 Fracture Symposium—Grand Ballroom
- 2 00 Surgical Film Exhibition—Boulevard Room
- 8 00 Community Health Meeting—Grand Ballroom

THE surgeons of Chicago, under the leadership of a representative committee, have prepared a program of clinics and demonstrations that will provide a complete showing of the clinical activities in all departments of surgery in this great medical center for the twenty seventh annual Clinical Congress of the American College of Surgeons, October 25-29. The Committee is assured of the hearty co-operation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

Published in tentative form in the following pages, the clinical program is to be further revised and amplified during the weeks preceding the Congress. Clinics are scheduled for the afternoon of Monday, October 25 and for the mornings and afternoons of each of the four following days. The final clinical program will be published from day to day during the Congress—a complete detailed program will be posted in the form of bulletins at headquarters at the Stevens Hotel each afternoon for the succeeding day and issued in printed form the following morning.

In addition to an ample and well arranged schedule of operative clinics demonstrating the technique of a wide variety of surgical procedures the Committee has arranged a series of demonstration clinics at the medical schools and in several of the larger hospitals where the work being done in many special fields will be presented including Neurosurgery, traumatic surgery, thoracic surgery, plastic surgery, fractures, cancer, orthopedics, gynecology and obstetrics, genitourinary surgery, experimental surgery, roentgenology, ophthalmology, otolaryngology, etc.

tion of hospital furnishings, equipment and supplies, food service, professional problems of the small hospital, the outpatient department, and other topics

Friday will be devoted to visiting hospitals. Nineteen local hospitals and the University of Chicago Clinics will hold demonstrations of a great many phases of hospital operation. These demonstrations have been completely pre arranged and delegates should select at the time they register the ones they wish to attend. Other hospitals may also be visited. Information will be supplied at the headquarters for hospital registration at the Congress.

COLLEGE EXHIBITS

In the scientific exhibit at the Stevens Hotel there will be included displays, charts tabulated results of surveys, and a variety of other material demonstrating the scope of the services rendered by the College.

The Library will have an exhibit and will have a representative available to demonstrate the work of the Department of Literary Research and to consult with persons desiring assistance in the compilation of bibliographies, the preparation of abstracts and translations, or any other service in this field. As each study is individual and personal, it is hoped that many visitors will utilize this opportunity to learn how the department can be of service to the individual doctor, wherever he may be located, in the study of specific problems in which he is interested, and to outline any research he may care to undertake at the time.

Graphs and tables will be displayed showing the progress of hospital standardization over twenty years. They will include in such a way as to be appreciated at a glance, information concerning various aspects of hospital operation and the improvement manifested through the years. A representative will be on hand to give information pertaining to hospital problems and to discuss the manner in which the College co-operates with hospital administrators in improving their practices.

The Department of Clinical Research will have a comprehensive exhibit, with charts showing the results of findings on five year cancer cures, progress in treatment of fractures, standardization of medical services in industry, and other material. Information concerning this important phase of the activities of the College will be supplied by a representative of the department.

These exhibits are supplemental to those which may be viewed at the administrative headquar-

ters of the College at 40 East Erie Street. All fellows of the College and other guests are cordially invited to visit this building and the adjoining John B. Murphy Memorial in order to familiarize themselves with the resources the College provides for them to further their knowledge and to help them in improving their technique. The buildings and furnishings in themselves are well worth inspection because of their unique character and their adaptation to the needs of the College and its fellows.

ADVANCE REGISTRATION REQUIRED

Invitations to attend this year's Clinical Congress in Chicago have been issued, at the direction of the Board of Regents, to fellows of the College, including the 1937 class of initiates, approved applicants for fellowship and members of the junior candidate group, and officially invited guests. Attendance at the Congress will be definitely limited to a number that can be readily accommodated at the clinics in the hospitals and at the scientific sessions at headquarters.

Those surgeons who wish to attend the Congress should register in advance, paying a registration fee of \$5.00. A formal receipt for the fee will be issued, which receipt is to be exchanged for a general admission card upon registration at headquarters. This card, which is non transferable, must be presented to secure clinic tickets and admission to evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, the number of tickets issued for any clinic being limited to the capacity of the room in which that clinic is given. This plan provides a means for the distribution of the visiting surgeons among the clinics and insures against overcrowding.

ANNUAL MEETING

The annual meeting of the governors and fellows of the College will be held in the grand ballroom of the Stevens Hotel on Thursday afternoon at 1:30 o'clock. Reports on the activities of the College will be presented by the officers and chairmen of standing committees, to be followed by the election of officers.

COMMITTEE MEETINGS

The attention of fellows is called to the meetings of three committees to be held in Memorial Hall of the College, 50 East Erie Street, Wednesday forenoon, as follows: State and Provincial Judiciary Committees at 9:30, State and Provincial Credential Committees at 10, State and Provincial Executive Committees at 11.

SURGICAL MOTION PICTURES

The showing of surgical motion picture films which so faithfully depict clinical features of major interest to most surgeons will be continued at this year's session. It is planned to present an enlarged program of both sound and silent pictures at daily exhibitions at headquarters.

INFORMATION BUREAU FOR VISITING LADIES

A committee of Chicago women will sponsor an information bureau to be established at headquarters to aid the wives and friends of visiting fellows in arranging for sight seeing trips, shopping tours and other activities in which they may be interested.

HEADQUARTERS AND TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Stevens Hotel where the grand ball room with its large foyers and other meeting rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments x ray apparatus operating room lights hospital apparatus and supplies of all kinds ligatures, dressings pharmaceuticals and publishers of medical books will be represented.

RAILWAY RATES

Although no special rates have been authorized by the railways for the Clinical Congress in Chi-

cago this year and certificates will not be required, the railways in the western northwestern southwestern, and southeastern states will offer for sale in October round trip tickets to Chicago at very low rates, with a 30 day return limit in certain territory and a 15 day return limit in other territory. Complete information as to rates, routes and stop over privileges may be obtained from local ticket offices. In the territory east of Chicago, north of the Ohio and Potomac Rivers including the north Atlantic and New England states and eastern provinces of Canada the regular rate of three cents per mile in pullmans and two cents per mile in coaches will be in effect.

CHICAGO HOTELS AND THEIR RATES

In addition to the headquarters hotel the Stevens there are several first class hotels within short walking distance of headquarters, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee.

	Minimum Rate with Bath	
	Single	Double
Auditorium 430 S Michigan Ave	\$2 50	\$4 00
Bismarck 171 W Randolph St	3 50	5 00
Blackstone Michigan Ave at 7th St	4 00	6 00
Congress 500 S Michigan Ave	3 00	5 00
Drake Michigan and Lake Shore Drive	4 00	6 00
Great Northern 237 S Dearborn St	2 50	4 00
Harrison 57 E Harrison St	2 50	3 50
Knickerbocker 103 E Walton Pl	3 00	5 00
LaSalle 10 N LaSalle St	3 00	4 50
Morrison 79 W Madison St	3 00	4 00
Palmer House 15 E Monroe St	3 50	5 00
Sherman 106 W Randolph St	2 50	4 00
Stevens 720 S Michigan Ave	3 00	4 50

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Comocation—Monday 8 00 P M —Ballroom, Stevens Hotel

Address of Welcome VERNON C DAVID, M D, Chicago, Chairman, Committee on Arrangements
 Introduction of Foreign Guests
 Address of the Retiring President EUGENE H POOL, M D, New York
 Inauguration of Officers
 Conferring of Fellowships FREDERIC A BESLEY, M D, Waukegan, Ill, President
 Conferring of Honorary Fellowships The President
 Medical Records Honor List and Prize Award The President
 Annual Oration on Surgery The Surgeon as a Biologist J P LOCKHART MUMMERY, M B, B Ch, F R C S, London, England

Tuesday, 8 00 P M —Ballroom, Stevens Hotel

Treatment of Peptic Ulcer
 Indications for Surgery JAMES H MEANS, M D, Boston
 Technique of Surgical Treatment ROSCOE R GRAHAM, M D, Toronto
 Nucleus Pulposus and Lower Back and Sciatic Pains HOWARD C NAFFZIGER, M D, San Francisco
 The Relation of Chronic Cystic Mastitis to Cancer of the Breast DEAN LEWIS, M D, Baltimore

Wednesday, 8 00 P M —Ballroom, Stevens Hotel

Greetings to the Visiting Surgeons GEORGE W POST, JR, M D, Chicago, President, Chicago Medical Society
 Lymphedema
 The Genesis and Consequences of Lymphedema CECIL K DRINKER, M D, Boston
 Circulatory and Lymphatic Disturbances in the Abdomen WILLIS D GATCH, M D, Indianapolis
 Diverticula of the Intestine CLAUDE F DIXON, M D, Rochester, Minn
 Immediate or Delayed Treatment of Acute Cholecystitis HENRY W CAVE, M D, New York

Thursday, 8 00 P M —Ballroom, Stevens Hotel

Tuberculosis of the Kidney FRANK HINMAN, M D, San Francisco
 Physiological and Pathological Changes in the Urinary Tract during Pregnancy I MASON HUNDLEY, JR, M D, Baltimore
 Acute Pancreatitis IRVIN ABELL, M D, Louisville
 Fracture Oration The Present Status of the Operative Treatment of Fractures WILLIAM O NEILL SHERMAN, M D, Pittsburgh

Community Health Meeting—Friday, 8 00 P M —Ballroom, Stevens Hotel

FREDERIC A BESLEY, M D, Waukegan, Ill, President, American College of Surgeons Presiding
 The American College of Surgeons—Its Aims and Objects GEORGE CRILE, M D, Cleveland, Chairman, Board of Regents, American College of Surgeons
 The Seven Wonders of Medicine BOWMAN C CROWELL, M D, Chicago Associate Director, American College of Surgeons
 The Approved Hospital—How It Benefits You MALCOLM T MACLACHERN, M D, Chicago, Associate Director, American College of Surgeons
 What Everyone Should Know about Cancer CLARENCE C LITTLE, Ph D, New York, Managing Director, American Society for the Control of Cancer
 Prenatal and Maternal Care FRANK W LYNCH, M D, San Francisco, Professor of Obstetrics and Gynecology, University of California Medical School
 Patients, Doctors and Hospitals ROBERT JOLLY, Houston, Superintendent, Memorial Hospital

PROGRAMS FOR EVENING MEETINGS—Continued

SURGERY OF THE EYE

Tuesday, 8 00 P M —North Ballroom Stevens Hotel

Surgery of the Cornea RAMÓN CASTROVIEJO, M D, New York

Exophthalmos ALBERT D RUEDEMANN, M D, Cleveland

The Modern Surgery of Retinal Detachment HARRY S GRADLE, M D, and SAMUEL J MEYER, M D
ChicagoDifferential Diagnosis and Surgical Treatment of Strabismus AVERY D PRANGEN, M D, Rochester,
Minn

Trachoma PETER C KRONFELD, M D, Peiping China

SURGERY OF THE EAR, NOSE, AND THROAT

*Thursday 8 00 P M —North Ballroom Stevens Hotel*The Surgical Treatment of Various Types of Lesions in the Petrous Pyramid SAMUEL J KOPETZKY, M D
New York

Infections of the Paranasal Sinuses of Dental Origin JOHN J SHEA, M D, Memphis, Tenn

Tumors of the Nasopharynx ALBERT C FLURSTENBERG, M D, Ann Arbor, Mich

The Significance of Hoarseness FRANCIS E JEJEUNE, M D, New Orleans

PROGRAMS FOR AFTERNOON SESSIONS

SYMPOSIUM ON CANCER

*Tuesday, 2 00 P M —Ballroom, Stevens Hotel*CHARLES A DUKES, M D, Oakland, Chairman of Committee on the Treatment of Malignant Diseases
presidingCorrelation of Body Segmental Temperature and Its Relation to Metastatic Carcinoma: Clinical Observa-
tions and Response to Methods of Refrigeration TEMPLE FAY, M D, GEORGE HENNY, M D, and
ALGUSTUS MCCRAVEY, M D, Philadelphia

The Treatment of Cancer of the Rectum J P LOCKHART MUMMERY, M B, B Ch, F R C S, London

Paget's Disease of the Nipple SIR GEORGE I ENTHAL CHEATLE, I R C S, London

Cancer of Esophagus JOHN H GARLOCK, M D, New York

Carcinoma of Thyroid HAROLD L FOOS, M D, Danville, Pa

The Role of Cystectomy in Malignant Tumors of the Bladder CHARLES C HIGGINS, M D, Cleveland

Presentation of Five Year Cures BOWMAN C CROWELL, M D, Chicago

SYMPOSIUM ON OBSTETRICS AND GYNECOLOGY

Wednesday 2 00 P M —North Ballroom Stevens Hotel

FRANK W LYNCH, M D, San Francisco, Vice President, American College of Surgeons, presiding

Conservatism in Obstetrics GEORGE W KOMAK, M D, New York

Water Balance in Relation to Toxemias of Pregnancy M EDWARD DAVIS, M D, Chicago

Abdominal and Pelvic Pain from the Gynecological Viewpoint ARTHUR H CURTIS, M D, Chicago

Caesarean Section JOHN R FRASER, M D, Montreal

Differential Diagnosis in Intestinal Urinary and Gynecological Diseases FLOYD E FEENE, M D, Phila-
delphia

Syphilis in the Pregnant Woman JAMES R MCCORD, M D, Atlanta

SYMPOSIUM ON GRADUATE TRAINING FOR SURGERY

Wednesday, 2 00 P M —Ballroom, Stevens Hotel

FREDERIC A BESLEY, M D, Waukegan, Ill, President, American College of Surgeons, presiding
 Opening Remarks GEORGE CRILE, M D, Cleveland, Chairman, Board of Regents, American College of Surgeons

Purpose of Conference MALCOLM T MACEachern, M D, Chicago, Associate Director, American College of Surgeons

Graduate Training for Surgery ALTON OCHSNER, M D, New Orleans

Findings from the 1937 Survey of Hospitals by the American College of Surgeons MELVILLE H MANSON, M D, Minneapolis, Special Field Representative

Discussion from the following viewpoints

The Surgeon in the Teaching Hospital DALLAS B PHEMISTER, M D, Chicago

The Surgeon in the Large Non Teaching Hospital DONALD GUTHRIE, M D, Sayre, Pa

The Surgeon in the Rural Community Hospital HOWARD L SNYDER, M D, Winfield, Kan

The American Surgical Association EUGENE H POOL, M D, New York

The American Board of Surgery EVARTS A GRAHAM, M D, St Louis

The American Medical Association FRED W RANKIN, M D, Lexington Ky

Significant Experiences in the Training of Surgeons on a Graduate School Basis LOUIS B WILSON, M D, Rochester, Minn

Discussion Otolaryngology—PERRY G GOLDSMITH, M D, Toronto, Urology—FRANK HINMAN, M D, San Francisco, Gynecology and Obstetrics—ARTHUR H CURTIS, M D, Chicago

SYMPOSIUM ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

Thursday, 3 00 P M —Ballroom, Stevens Hotel

FREDERIC A BESLEY, M D, Waukegan, Ill, Chairman of Committee on Industrial Medicine and Traumatic Surgery, presiding

Recognition and Prevention of Lead Poisoning ROBERT ARTHUR LEHOE, M D, Cincinnati

Reconstruction Surgery of the Face and Jaws DR MED WOLFGANG ROSENTHAL, Leipzig

Injuries of the Chest and Abdomen EDMUND BUTLER, M D, San Francisco

The Modern Concept of the Industrial Medical Problem M N NEWQUIST, M D, Chicago

Reconstruction of Scalp and Ear by Tube Graft Method JAMES A CAHILL JR, M D, Washington, D C

Physical Therapy in Relation to Industrial Surgery KRISTIAN G HANSSON, M D, New York

SYMPOSIUM ON FRACTURES

Friday, 2 00 P M —Ballroom, Stevens Hotel

FREDERIC W BANCROFT, M D, New York, Chairman of Committee on Fractures, presiding

Organization of Regional Fracture Groups CHARLES L SCUDDER, M D, Boston

Functional Disabilities after Simple Fracture FRASER B GURD, M D, Montreal

Fractures of the Shaft of the Humerus J HUBER WAGNER, M D, Pittsburgh

Topic to be announced WILLIAM H OGILVIE, F R C S, London

Fractures of the Bones of the Hand HUBLEY R OWEN, M D, Philadelphia

Malunion in Fractures WILLIS C CAMPBELL, M D, Memphis, Tenn

Fracture of Both Bones of the Forearm (excluding Colles' Fracture and Fractures into the Elbow Joint)

WILLIAM B CARRELL, M D, Dallas, Texas

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday 10 00—Ballroom Stevens Hotel

EUGENE H POOL M D New York, President American College of Surgeons presiding

President's Address

Report of the 1937 Survey of Hospitals and Official Announcement of the Approved List GEORGE CRILE M D Cleveland Chairman Board of Regents American College of Surgeons

The Approved Hospital and Its Obligation—Diagnosis and Therapy Education, Prevention and Research DEPT W CALDWELL M D Chicago

Personality and Psychology in the Hospital G HARVEY AGNEW M D Toronto

Trends in Medical Education JOHN H J UPHAM, M D Columbus Ohio

Criteria to be Observed When Selecting Internes and Residents JAMES H MEANS M D Boston

Surgical Organization in Non University Connected Hospitals CHARLES A BOWERS M D Cleveland

The Effect Hospital Insurance Plans Are Having on Medical and Hospital Services C RUFUS KOREM, Ph D Chicago

Monday 11 00—Ballroom Stevens Hotel

GEORGE E. WILSON M B Toronto Vice President, American College of Surgeons presiding

The Medical Staff Conference—with Panel Discussion from the Following Viewpoints

General Presentation of Subject HAROLD L FOSS, M D Danville Pa

Proper Attitude of the Medical Staff JAMES T NIX M D New Orleans

Time Place and Physical Essentials WILLIAM H WALSH M D Chicago

Conduct of the Conference EDWARD L LUOHY M D Duluth Minn

Criteria of a Good Medical Staff Conference FELIX P MILLER M D El Paso Texas

Demonstration—A model medical staff conference by the medical staff of Ravenswood Hospital Chicago

Tuesday 10 00—North Ballroom Stevens Hotel

F WELDON YOUNG M D Seattle Wash presiding

Clinical Departments of the Hospital Embracing Organization Direction Control Functioning

Oral Surgery and the Dental Department in the General Hospital WILLIAM H G LOGAN M D, Chicago

Psychiatric Department in the General Hospital SAMUEL W HAMILTON M D New York

The Physical Therapy Department in Small Medium and Large General Hospitals JOHN S COULTER M D Chicago

The Out Patient Department in the General Hospital CHRISTOPHER G PARNALL M D Rochester N Y

The Obstetrical Department in the General Hospital OTTO H SCHWARZ M D St Louis

Tuesday 11 00—North Ballroom Stevens Hotel

FRED G CARTER M D Cincinnati presiding

Group Hospital Administration D ALLAN CRAIG, M D Torrington Conn

Hospital Personnel Management—with Panel Discussion from Various Viewpoints

General presentation of subject FRANK J WALTER Denver

Selection I MURIEL LACOMBE RN St Louis

Physical Health HAROLD L SCAMMELL M D Halifax

Assignment of Duties CLINTON F SMITH Chicago

Working and Living Conditions JOSEPH G NORBY Milwaukee

Morale MACIE N KNAPP RN Normal Ill

Training and Education of Hospital Personnel GEORGE O HANLON M D Jersey City N J

Tuesday, 8 00 P M—Boulevard Room Stevens Hotel

Joint Session with Chicago Hospital Association and Chicago Hospital Council CHARLES H SCHWEPPE Chicago presiding

Public Relations—with Panel Discussion from the Following Viewpoints

General presentation of subject PERRY ADDLEMAN Chicago

The Hospital Administrator ADA BELLE MCCLEERY RN Evanston Ill

The Member of the Medical Staff FREDERIC J COTTON M D Boston

The Press HOWARD W BLAKESLEE New York

Fund Raising PAUL H FISLER Chicago

Community Good Will A LOWARD A HUDSON Waynesboro Va

Wednesday 10 00—North Ballroom Stevens Hotel

Joint Session with Association of Record Librarians of North America R C BLENNI M D Madison Wis presiding

Developing a Medical Record Consciousness in the Hospital SISTER M PATRICIA OSB BS, RRL Duluth Minn

What Constitutes a Proper Appraisal of the Medical Record CHARLES B PUESTOW M D, Chicago and LILLIAN H ERICKSON RRL Milwaukee

Incomplete Medical Records—Causes and Remedies ALICE G AIRLAND, RRL Oakland Calif

The Remunerative Value of Good Medical Records RICHARD B DAVIS M D Greensboro N C

The Technique of Making Group Studies of Diseases THOMAS R LINTON M D Chicago

Wednesday 2 00—Grant Hospital

Conversation Round Table Conference—Your and My Medical Records Problem and How We Solve Them EDNA A HUFFMAN RRL Chicago Co coordinator

ESTHER BADGER RRL San Leandro Calif GENE VIEVE CHASE RRL Boston JESSIE N HARNED RRL Rochester N Y ADALINE HAYDEN RRL Chicago HELEN A HAYES RRL Cleveland Sister M HILDA RRL Joliet Ill JENNIE C JONES RRL Baltimore WESLEY A SMITH RRL Mt McGregor N Y ELIZABETH K TERHUNE RRL Davenport Iowa EVELYN VREDEBURG RRL New York

Playlet—History Is Made in a Clinic—Presented by the Medical Records Librarians Children's Memorial Hospital Chicago

Thursday 10 00—North Ballroom Stevens Hotel

Panel Round Table Conference—Problems Relating to Hospital Administration and Hospital Standardization Conducted by ROBERT JOLLY Houston Texas and R C BLENNI M D Madison Wis

Call Systems for Hospitals JOHN CORRELL, M D, Grand Rapids Mich

Administrative Problems of the Small Hospital GLADYS BRANDT, R N, Logansport, Ind
 Nursing Service SISTER MARY LIDWINA, Chicago
 Medical Social Service Standards BABETTE JENNINGS, Chicago
 Air Conditioning in Hospitals PERRY W SWERN, Chicago
 Hospital Income BRUCE L TWITTY, Dallas, Texas
 The Hospital Pharmacy EDGAR C HAYHOW, Paterson, N J

Thursday, 2:00—North Ballroom, Sletens Hotel
 Standardization of Hospital Furnishings, Equipment and Supplies JOHN N HATFIELD, Philadelphia
 Food Service MIRIAM C CONNELLY, Baltimore
 Professional Problems of the Small Hospital MARY E SKEOCH, R N, Marquette, Mich
 Nursing Education MARY M ROBERTS, R N, New York

Out Patient Department FREDERICK MACCURDY, M D, New York
 The Cancer Clinic in the General Hospital FRANK E ADAIR, M D, New York
 The Front Office of the Hospital LEE C GAMMILL, Little Rock, Ark

Friday 10:00 and 2:00

An opportunity will be afforded the hospital delegates to visit Chicago hospitals. Demonstrations in the following hospitals will be arranged: Augustana, Chicago Lying In, Chicago Memorial, Children's Memorial, Cook County, Grant, Henrotin, Michael Reese, Mount Sinai, Passavant Memorial Presbyterian, Ravenswood, Research and Educational St Elizabeth's, St Joseph's, St Luke's, St Mary of Nazareth, University of Chicago Clinics, Wesley Memorial West Suburban.

COMMITTEE ON ARRANGEMENTS

Executive Committee

VERNON C DAVID, *Chairman*
 MICHAEL L MASON, *Secretary*

FRED L ADAIR
 RALPH B BETTMAN
 ALEXANDER BRUNSCHWIG
 FREDERICK CHRISTOPHER
 WARREN H COLE
 EDWARD L COMPERE
 JOHN S COULTER

WILLIAM R CUBBINS
 HARRY CULVER
 LOYAL DAVIS
 GEORGE DETAROWSKY
 LESTER R DRAGSTEDT
 HARRY GRADLE
 M J HUBENY

SELIM W MCARTHUR
 KARL A MEYER
 ALBERT H MONTGOMERY
 OSCAR E NADEAU
 DALLAS B PEMISTER
 SAMUEL SALINGER
 C F SAWYER

HOSPITAL REPRESENTATIVES

Alexian Brothers Hospital—DANIEL MURPHY
 Augustana Hospital—OSCAR NADEAU
 Albert Merritt Billings Hospital—DALLAS B PEMISTER
 Chicago Lying In Hospital—FRED L ADAIR
 Chicago Memorial Hospital—PETER CLARK
 Children's Memorial Hospital—ALBERT H MONTGOMERY
 Columbus Hospital—DANIEL ORTH
 Cook County Hospital—KARL A MEYER
 Englewood Hospital—WILLIAM S HECTOR
 Evangelical Hospital—G HENRY MUNDT
 Evangelical Deaconess Hospital—E M HEACOCK
 Evanston Hospital—FREDERICK CHRISTOPHER
 Garfield Park Community Hospital—JOHN R HARGER
 Grant Hospital—A G ZIMMERMAN
 Henrotin Hospital—CHARLES PUESTOW
 Holy Cross Hospital—JOHN F RUZIC
 Illinois Central Hospital—WILLIAM T HARSHA
 Illinois Eye and Ear Infirmary—THOMAS D ALLEN
 Illinois Masonic Hospital—CHARLES H PARKES
 Jackson Park Hospital—ARRIE BAMBERGER
 Lewis Memorial Hospital—MORGAN J O'CONNELL
 Lutheran Deaconess Hospital—GEORGE H SCHROEDER
 Lutheran Memorial Hospital—HENRY BUXBAUM
 Mercy Hospital—CHARLES F SAWYER
 Mother Cabrini Memorial Hospital—EUGENE J CHESROW
 Mount Sinai Hospital—A E KANTER
 Municipal Contagious Hospital—ARCHIBALD I HOYNF
 Municipal Tuberculosis Sanitarium—J F O M CZAJA

Northwestern University Medical School (Ophthalmological Department)—SANFORD R GIFFORD
 Norwegian American Hospital—WARREN JOHNSON
 Passavant Memorial Hospital—LOYAL DAVIS
 Post Graduate Hospital—RICHARD A LIEVENDAHL
 Presbyterian Hospital—ALBERT H MONTGOMERY
 Ravenswood Hospital—GEORGE DETAROWSKY
 Michael Reese Hospital—RALPH B BETTMAN
 Research and Educational Hospitals—WARREN H COLE
 Rush Medical College (Ophthalmological Department)—WILLIAM J MONCREIFF
 St Anne's Hospital—THOMAS E MEANY
 St Anthony de Padua Hospital—FRED SLOBE
 St Bernard's Hospital—S L GOVERNALL
 St Elizabeth's Hospital—MARTIN G LUKEN
 St Francis Hospital—W L WANER
 St Joseph's Hospital—AUSTIN A HAYDEN
 St Luke's Hospital—SELIM W MCARTHUR
 St Mary of Nazareth Hospital—GEORGE MUELLER
 Shriners' Hospital—BEVERIDGE MOORE
 South Shore Hospital—GUY VAN ALSTYNE
 Swedish Coenant Hospital—KARL L VEHRE
 U S Marine Hospital—M J WHITE
 University of Chicago (Ophthalmological Department)—E V L BROWN
 Veterans Administration Facility—PAUL BROWN
 Washington Boulevard Hospital—ARTHUR METZ
 Wejley Memorial Hospital—R W MCNEALY
 Frances C Willard Hospital—JAMES A VALENTINE
 Women and Children's Hospital—AUDE H WINNETT

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS GENERAL SURGERY, GYNECOLOGY AND OBSTETRICS
ORTHOPEDIC SURGERY, FRACTURES AND TRAUMATIC SURGERY, GENITO URINARY SURGERY, THORACIC
SURGERY, NEUROSURGERY, ROENTGENOLOGY, TUMORS AND IRRADIATION, PHYSICAL THERAPY PLAS
TIC AND FACIOMAXILLARY SURGERY, EXPERIMENTAL SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL

CHARLES J DRUECK SR GEORGE L BROOKS OTTO
SAPHIR and GEORGE LANDAU Symposium Carcinoma
of the rectum carcinoma of the colon
CHARLES E KAHLKE GEORGE L BROOKS OTTO SAPHIR
and GEORGE LANDAU Symposium Peptic ulcer

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

SUMNER L KOCH MICHAEL L MASON and HARVEY S
ALLEN Surgery of the hand Dupuytren's contracture
Volkmann's contracture nerve and tendon suture burn
contractures of the hand and plastic repair with skin
grafts chronic tenosynovitis

ST ANTHONY DE PADUA HOSPITAL

R C DRLRY Spinal anesthesia

ST BERNARD'S HOSPITAL

W S HECTOR and S S DUBOVY Imperforate anus with
atresia of large bowel
B C CUSHWAY R J MAIER and E K LEWIS Roentgen
therapy of inflammation and infection of face and neck
ROCCA FAZIO Blood transfusion and merits of accepted
methods

WOMEN AND CHILDREN'S HOSPITAL

CLEMENTINE FRANKOWSKI and HELEN M KOSTKA Vari
cose veins Treatment by injection and by ligation
anatomic demonstration

Tuesday Morning

AUGUSTANA HOSPITAL

N M PERCY Operations

ALBERT MERRITT BILLINGS HOSPITAL

D B PREMISTER L R DRAGSTEDT A BRUNSCHWIG
W E ADAMS and associates Operations
Symposium Gastro-Intestinal Surgery
LESTER R DRAGSTEDT and staff Clinical and experimen
tal studies in gastric and duodenal ulcer
WALTER L PALMER F E TEMPLETON and RUDOLF
SCHINDLER X ray and gastroscopic studies of gastric
ulcer under medical treatment
A BRUNSCHWIG Pancreatoduodenectomy for carcinoma
of the head of the pancreas
H P JENKINS Abdominal wound disruption and the
durability of catgut sutures

CHICAGO MEMORIAL HOSPITAL

CHARLES E KAHLKE Stomach surgery
CHARLES J DRUECK SR Surgery of the colon and rectum

COOK COUNTY HOSPITAL

HARRY JACKSON and PHILIP SHAPIRO Symposium Skull
fractures
KARL A MEYER R H JAFFE M J HUBENY AARON
ARKIN and RUDOLF SCHINDLER Symposium Surgery of
the stomach with operative clinic
DR GATEWOOD and S LAWTON Fracture surgery in chil
dren
GEORGE DAVIS Operations
A H MONTGOMERY and F H STRAUS Operations
JOHN HARGER and A J STOKES Peridural anesthesia in
abdominal operations with operative clinic
HARRY JACKSON and PHILIP SHAPIRO Operations
J G FROST and J M ROBERTS Operations
LONDON SEED Operations
VICTOR L SCHIRAGER and B J FITZGERALD Symposium
Appendicitis
Members of the surgical staff will give demonstrations
in surgical technique upon cadavers and dogs in the
laboratories of the Graduate School of Medicine 427 S
Honore Street J L SPIVACK Gastrotomy

EVANGELICAL DEACONESS HOSPITAL

LDWARD N HEACOCK Cholecystectomy
GARFIELD PARK COMMUNITY HOSPITAL
Symposium Gall Bladder Disease
EDMUND FOLEY Etiology and diagnosis
HAROLD N WAIT X ray diagnosis
SAMUEL PLICE Heart in gall bladder disease
FRED DE STEFANO Anesthesia
CLAUDE WEIDY Surgery

GRANT HOSPITAL

KARL A MEYER and LONDON SEED Operations and dem
onstration of cases

HOLY CROSS HOSPITAL

V F TORCZYNSKI Cholecystectomy appendectomy hys
terectomy
M J BADZMIEROWSKI Thyroidectomy, 5 cases cholecys
tectomy
J DYBALSKI Cholecystectomy 3 cases nephrectomy
hysterectomy
A J MANIKAS Appendectomy

JACKSON PARK HOSPITAL

G M LUCAS Operations
W MORLEY SHERIN Gall bladder surgery
Symposium Appendicitis
A BAMBERGER Surgical aspect
R R JAMIESON Medical aspect
J J MOORE Pathological aspect

LUTHERAN DEACONESS HOSPITAL

JOHN D KOLCAY G H MAMMEN and GEORGE H
SCHROEDER Operations

MERCY HOSPITAL

Dry Clinic

C F SAWYER and W O FITZGERALD Unusual causes of intestinal obstruction, partial and complete gastrectomy
M MCGUIRE and J H MOHARDT Pelvic appendicitis, obstructive jaundice

MOUNT SINAI HOSPITAL

V SCHRAGER Operations

J GAULT Technique of high internal saphenous vein ligation

P KAPLAN Tubulovaginal gastrectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

CLEMENT MARTIN, A C WENDT and LOUIS MORRIS
Anorectal tuberculosis demonstration of ulceration of gastro intestinal tuberculosis, rectal fistulae and other anorectal lesions

MAX THOREK and PHILLIP THOREK General surgery in tuberculous patients

JOHN S COULTER, LEO HARDT, MAURICE WEISSMAN and LEON GORFINKEL Ultraviolet radiation in the treatment of gastro intestinal tuberculosis study of over 200 cases, comparison of the therapeutic effects of high vitamin smooth diet calcium and ultraviolet radiation

NORWEGIAN AMERICAN HOSPITAL

WARREN JOHNSON Operative gynecological and abdominal surgery

M E LICHTENSTEIN Extrabiliary passages, demonstration of specimens with clinical and physiological significance

J V FOWLER and DR FISHBACK Clinical and pathological conference, ovarian tumors with microprojectoscopic demonstration

PRESBYTERIAN HOSPITAL

KELLOGG SPEED, ALBERT H MONTGOMERY, DR GATEWOOD and associates Operations

Dry Clinic

VERNON C DAVID Selection of operation in carcinoma of large bowel

CARL B DAVIS Methods of closure of duodenal fistulae

LDWIN M MILLER Nonfunctional gastro enterostomy

MARK LORING Extra congenital lesions of granuloma inguinale

R GILCHRIST Demonstration of lymphatic extension in carcinoma of large bowel

HILIER L BAKER Lipiodol visualization of the bile tract

E H FELL Complications encountered in 500 blood transfusions

RAVENSWOOD HOSPITAL

P J SARMA Varicose veins, ligation and obliterative treatment

R E DYER End results of gastro enterostomies, demonstration of cases

D B POND and R F GREENING Osteomyelitis

J J MOORE Tumors of breast

D L JENKINSON X ray interpretations

GEORGE DE TARNOWSKY Extrophy of bladder

C J GEIGER Ectopic ureter and absence of vagina, cervical carcinomas

M W FIELD Obstetric practice by general practitioner

W F GROSSENER Toxemia in pregnancy

W C HAMMOND Endometriosis

MICHAEL REESE HOSPITAL

D C STRALS Thyroid operations

RALPH B BETTMAN and WILLIAM TANNENBAUM Gall bladder surgery

A A STRAUSS Gastro intestinal surgery

JAMES PATEJDL Operations

P SHAPIRO Operations

Symposium Gastro Intestinal Diseases

A A STRAUSS Surgical treatment of peptic ulcer

S STRAUSS Pre and postoperative care of the ulcer patient

JAMES PATEJDL Perforating ulcer, surgical treatment

JACOB MEYER Medical care of the ulcer patient

Symposium Carcinoma of the Rectum

A A STRAUSS Surgical management

S STRAUSS Surgical diathermy, after care and results of surgical diathermy

M APPEL Histiocytic variation in cancer tissue

GUSTAV KOLISHER History of surgical diathermy

OTTO SAPHIR Pathology of the rectum following surgical diathermy

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DETAKATS Lumbar sympathectomy operation

Symposium Neurocirculatory Diseases

R BRUNNER Use of neosynephrine in spinal anesthesia

PAUL M SMITH Mechanisms governing peripheral circulation

WILLIAM C BECK Selection of cases for sympathectomy, demonstration of sympathectomized patients, evaluation of results, management of lymphedema

F K HICK Vascular accidents associated with coronary disease

H C LUETH Unusual reactions following the use of nitroglycerine

GEZA DETAKATS Treatment of acute arterial occlusion, operability of hypertension, demonstration of cases

EUNICE ROYH Observations on and results of suction and pressure (pneumatic) therapy

P J SARMA and H L MISHKIN Varicose veins and ulcers

J T REYNOLDS Amputations in peripheral vascular disease

ST ANTHONY DE PADUA HOSPITAL

JOSEPH ZABOKRTSKY Operations

ST BERNARD'S HOSPITAL

J T MEYER E J MEYER and R J MEYER Thyroidectomy

W G EPSTEIN and M MENNIE Abdominal surgery and differential diagnosis of acute abdominal lesions

ST JOSEPH'S HOSPITAL

WILLIAM C BECK Thoracic surgery

ARCHIBALD HOYNE Control of contagion in surgical diseases

WILLIAM H G LOGAN Oral surgery

FRANKLIN B MCCARTY Gall bladder surgery

CHARLES M MCKENNA Undescended testicle

HUGH MCKENNA Fractures Conservative surgery in diabetic gangrene

FRANK THEIS Peripheral circulatory diseases

Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES, pathologist, and WILLIAM E ANSPACH radiologist

ST LUKE'S HOSPITAL

WILLIAM R CUBBINS Arthroplasties of hip joint

GUY PONTIUS Regional ileitis, local bowel resection for malignancy

H I MEYER Hashimoto's disease

H E MOCK Operations

ST MARY OF NAZARETH HOSPITAL

EDWARD WARSZEWSKI GEORGE R MUELLER and J C HILL Ulcerative colitis—diagnosis and treatment case histories demonstration of specimens
G MUELLER and J C HILL Regional ileitis—histories diagnosis treatment demonstration of specimens

SOUTH SHORE HOSPITAL

HUGH MACKECHNIE Surgical treatment of peptic ulcer

VETERANS ADMINISTRATION FACILITY

PAUL F BROWN BENJAMIN F WARD, JOSEPH E BARRS and MERRILL H JUDD Operations

WESLEY MEMORIAL HOSPITAL

R W MCNEALY E R STRAUSSER and F L HUSSEY Gastric surgery pre-operative decompression and post operative fluid management

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

BENNETT R PARKER Thyroid surgery

COOK COUNTY HOSPITAL

E J LEWIS and E LATIMER Operations

HOLY CROSS HOSPITAL

M J BADZMIEROWSKI Pre and postoperative treatment of thyroid disease
M HOELTGEN Surgical anatomy and pathology of tonsil

JACKSON PARK HOSPITAL

HARRY E L TIMM Operations

MERCY HOSPITAL

C L MARTIN Rectal neoplasms and inflammations
J E KELLEY The hernia problem

MUNICIPAL CONTAGIOUS DISEASE HOSPITAL

ARCHIBALD HOVNE and associates Intubation and tracheotomy discussion of the advantages and disadvantages of intubation and tracheotomy

PASSAVANT MEMORIAL HOSPITAL

J R BLICHINDER A C IVY and ARTHUR BYFIELD Symposium on the biliary tract

MICHAEL REESE HOSPITAL

Dry Clinic

NATHAN CROHN The use and abuse of the injection treatment of hernia suitable and unsuitable cases methods
LEO ZIMMERMAN Surgery of direct inguinal hernia
RUDOLF SCHINDLER The use of the gastroscope and its value to the surgeon

SAMUEL GOLDBERG Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections

JAMES PATEJDL Congenital duodenal obstruction in newborn duodenal diverticuli causing clinical symptoms

Dry Clinic

LEO ZIMMERMAN Diseases of veins
PHILIP SHAPIRO Recent advances in the treatment of varicose veins

BERNARD PORTIS Embolism of the peripheral arteries
SAMUEL PERLOW Surgical measures used in the treatment of peripheral circulatory disturbances differentiation between arterial and arteriolar spasm as an aid in the selection of cases for sympathectomy ganglionectomy

ST LUKE'S HOSPITAL

WILLIAM HAZLETT Pseudohermaphroditism carcinoma of breast in a fifteen year old girl

ST MARY OF NAZARETH HOSPITAL

P DORETTI and T PLANT Abdominal operative clinic
J C HILL Operations

VETERANS ADMINISTRATION FACILITY

PAUL F BROWN Symposium Stomach surgery—gastroenterostomy pyloroplasty, gastric resection with technique of operations

WOMEN AND CHILDREN'S HOSPITAL

Management of Diseases Complicating Surgery
CAROLYN MACDONALD Syphilis
ROSE MENENDIAN Endocrine disorders
RUTH RENTER DARROW Diabetes

Wednesday Morning

AUGUSTANA HOSPITAL

A T LUNDGREN EARL GARSIDE, R J E OWEN and J W NUZUM Operations

ALBERT MERRITT BILLINGS HOSPITAL

D B PEMISTER, L R DRAGSTEDT A BRUNSCHWIG
W E ADAMS and associates Operations

CHICAGO MEMORIAL HOSPITAL

PETER S CLARK, VANCE RAWSON, GEORGE LANDAU and OTTO SAPHIR Gall bladder symposium Surgical aspect medical aspect x ray and pathological aspect.
LEO M ZIMMERMAN and RICHARD T HELLER Fundamental problems in the surgical treatment of inguinal hernia modern management of varicose veins

CHILDREN'S MEMORIAL HOSPITAL

ALBERT H MONTGOMERY and associates Operations
Dry Clinic
ALBERT H MONTGOMERY Abdominal tumors in children
W J POTTS Appendicitis in children
JAY IRELAND Mesenteric lymphadenitis

COLUMBUS HOSPITAL

D A ORTH F MUELLER and E D NORA Bone and joint tuberculosis tuberculous peritonitis Rollier treatment.
J L SRIVASTAVA Spivack's gastrostomy valve operation
L A MACALUSO Cystocele rectocele and hysterectomy

COOK COUNTY HOSPITAL

R W MCNEALY MANUEL LICHTENSTEIN FREDERICK TICE RICHARD H JAFFE and M J HLBENY Symposium Diseases of the gall bladder, operations
V L SCHRAGER and B J FITZGERALD Operations
GEORGE APPELBACH and H VORIS Operations
R T VAUGHAN and H BAKER Operations
MARSHALL DAVISON and L J ARIES Operations
EDWIN M MILLER and EDGAR TURNER Symposium Children's surgery with operative clinic
Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine 427 S Honore Street M LICHTENSTEIN Cadaver demonstration of some principles in gall bladder surgery

EVANSTON HOSPITAL

Symposium Surgery of Colon and Rectum
 L D SVORF Diagnosis
 E R CROWDER Roentgenology
 E L BENJAMIN Pathology
 FREDERICK CHRISTOPHER Surgery
 W R PARKES Prognosis in malignancy

GRANT HOSPITAL

SYLVAN COOMBS and GEORGE APPELBACH Operations and demonstration of cases

HOLY CROSS HOSPITAL

CHARLES M MCKENNA Cholecystectomy herniorrhaphy
 J DYBALSKE Open reduction of fracture of femur
 F KRAFT Hysterectomy, perineorrhaphy
 F SALETTA Hysterectomy perineorrhaphy operation for shortening round ligament
 M STRIKOL Appendectomy, herniorrhaphy
 A RAKAUSKAS Appendectomy
 R LAWLER Cholecystectomy

JACKSON PARK HOSPITAL

ARRIE BAMBERGER Pre and postoperative treatment of surgical cases
 C C CLARK and H HOYT COX Operations

LUTHERAN DEACONESS HOSPITAL

GEORGE O SOLEM Surgical indications in peptic ulcer

MOTHER CABRINI HOSPITAL

FUGENE J CHESROW ALBERT J CHESROW, E P OLIVIERI and N V EMANUELE Operations and demonstrations
 Obstructive cholecystitis due to constricting bands of adhesions in a child 5 years old, use of papain in post operative adhesions

MOUNT SINAI HOSPITAL

E I GREENE Anaerobic hemolytic streptococcus infection (Meleney's disease)
 JACOB M MORA Thyroidectomy in the aged
 D WILLIS Removal of foreign (metallic) bodies from tissues with aid of a new instrument
 J M GREENE Acute intestinal obstruction
 I TRACE Postoperative pulmonary complications with special reference to massive pulmonary collapse
 M L ARLIN The surgical diabetic
 L EDWIN and N I FOX Medicosurgical discussion
 L FELDMAN Streptococcal bacteremia precipitated by surgical procedures

POSTGRADUATE HOSPITAL

EMIL RIES Episacro iliac lipomas with backache

PRESBYTERIAN HOSPITAL

V C DAVID, KELLOGG SPEED C B DAVIS DR GATEWOOD L M MILLER, A H MONTGOMERY and associates Operations

MICHAEL REESE HOSPITAL

M L PARKER LEO ZIMMERMAN and SAMUEL GOLDBERG Operations
 B FORTIS Thyroid surgery
 SAMUEL PERLOW Peripheral vascular surgery
 A A STRAUSS S STRAUSS and J PATEJDL Gastro intestinal surgery
 RALPH B BETTMAN and WILLIAM TANENBAUM Gall bladder operations

Dry Clinic Surgery of the Gall Bladder
 SAMUEL SOSKIN Preparation of the liver for surgery
 R A ARENS The technique of cholecystography
 A M SERBY, S FORTIS and G LICHENSTEIN The evaluation of liver function tests, gall bladder diet, survey of postoperative results of the gall bladder group
 RALPH B BETTMAN, LEO ZIMMERMAN and WILLIAM TANENBAUM Motion picture and diagrammatic demonstrations The technique of cholecystectomy, cholecystostomy, cholecdochogastrostomy or enterostomy

RESEARCH AND EDUCATIONAL HOSPITALS

W H COLE Thyroidectomy, operation for pyloric obstruction
 P J SARMA and H L MISHKIN Clinic on varicose veins
 Symposium Diseases of the Thyroid
 W H COLE Pre operative care and postoperative complications
 L SEED and R BRUNNER Blood pressure studies during thyroidectomy
 J M MORA Hepatic damage in hyperthyroidism
 R W KEETON Cardiac complications of hyperthyroidism
 JOHN HOWE The thyroid gland as observed at autopsy in patients with diseases other than hyperthyroidism
 C B PUESTOW Use of silk in thyroidectomy

ST ANNE'S HOSPITAL

THOMAS E MEANY Multiple fractures of leg including impaction of tibia into knee joint, fracture through the acetabular cavity dislocation of hip, fracture of humerus, new method for ambulatory traction of fractured femurs in children, tendon transplantation of paralytic club foot and correction Paget's disease treatment, one treated eighteen months, one two months, the other one month
 JOHN L KNAPP and JOHN W KEANE Pyloric obstruction—child 22 days old, child 28 days old, patient 76 years old, patient 43 years old, diverticulitis 3 cases
 GEORGE F THOMPSON Carcinoma of the gastro intestinal tract, biliary tract, breast

ST ANTHONY DE PADUA HOSPITAL

S E DONLON and H P SULLIVAN Operations and demonstration of cases

ST BERNARD'S HOSPITAL

J M MAHONEY Infective granuloma of the cecum simulating a neoplasm demonstration of case
 HERMAN DEFELO Medical management of cholelithic disease
 B C CUSHWAY and associates Roentgen studies of gall bladder diseases
 S L GOVERNALE Cholecystostomy vs cholecystectomy
 CHESTER C GUY Pathology of the gall bladder

ST LUKE'S HOSPITAL

S W MCARTHUR and associates Symposium Surgical conditions of the gall bladder and common duct
 L L JENKINSON X ray diagnosis
 GRANT LAING Pre operative and postoperative care
 S W MCARTHUR Operative indications, type of procedure with some technical details

SOUTH SHORE HOSPITAL

AXEL WERELIUS Biliary tract surgery

U S MARINE HOSPITAL

O I NADFAI Results in hernia surgery
 E C LITTON and R W FLYNN Spinal anesthesia

WESLEY MEMORIAL HOSPITAL

WILLIAM MILLER and WILLIAM A. LOEPPERT Review of gall bladder surgery at Wesley during past 25 years

FRANCES E. WILLARD HOSPITAL

VICTOR L. SCHRAGER. Clinic

WOMEN AND CHILDREN'S HOSPITAL

PEARL M. STETLER and CLEMENTINE FRANKOWSKI. General surgery and gynecology

Wednesday Afternoon
COLUMBUS HOSPITAL

E. D. NORA and THOMAS A. CARTER. Pathological demonstration

THOMAS A. CARTER. Goiter surgery

D. A. ORTH, C. J. SUTHERLAND and E. D. NORA. Experimental thyrotoxicosis

EVANSTON HOSPITAL

JAMES GRIER. Common bile duct obstructions

W. K. JENNINGS. Prevention of recurrence in femoral hernia operations

J. I. FARRELL. Undescended testicles

MICHAEL REESE HOSPITAL

SAMUEL PERLOW. Paravertebral alcohol injection for the relief of cardiac pain

LEO ZIMMERMAN and OTTO SAPHIR. Benign tumors of the thyroid gland

SAMUEL GOLDBERG. Acute mesenteric lymphadenitis, strangulated hernias in premature infants

THOMAS J. MERAR. Rectal complications of lymphogranuloma inguinale

CASPER EPSTEIN. Fractures of the jaws

M. L. PARKER. Carcinoma of the large bowel

ST. ANNE'S HOSPITAL

HARRY J. DOOLEY. Malignancy of kidney and bladder, urinary calculi and kidney stone, lantern slide demonstration

JOHN J. GEARIN. Ruptured gastric ulcer complicated by acute ileus, postoperative ruptured gastric ulcer complicated by acute appendicitis, fracture of tibia and fibula, demonstrating walking caliper

E. P. GRAMER. Repair of six hernia cases with fascia lata demonstration of abnormal cases of hernia

HARRY M. PETERSON. Emergency surgery demonstration of ruptured stomach and ileus, ruptured appendix

WESLEY MEMORIAL HOSPITAL

GUY S. VAN ALSTINE. Abdominal surgery. Rationalization of pre and postoperative treatment.

FRANCES E. WILLARD HOSPITAL

LOUIS F. PLZAK. Clinic

Thursday Morning
AUGUSTANA HOSPITAL

N. M. PERCY. Operations

ALBERT MERRITT BILLINGS HOSPITAL

D. B. PHENISTER, L. R. DRAGSTEDT, A. BRUNSCHWIG, W. E. ADAMS and associates. Operations

CHICAGO MEMORIAL HOSPITAL

PETER S. CLARK, LEO M. ZIMMERMAN and M. L. WEINSTEIN. Gall bladder surgery

COOK COUNTY HOSPITAL

GEORGE DAVIS. Operations

A. H. MONTGOMERY and F. H. STRAUS. Operations.

MAN THOREK and PHILLIP THOREK. Operations.

RICHARD H. JAFFE. Pathological conference.

Symposium. Diseases of the Thyroid Gland

MARSHALL DAVISON and L. J. ARIES. Multiple stage operations in poor risk patients, the fallacy of post-operative iodine

LINDON SEED. Postoperative complications.

C. C. MAHER. The heart in thyrotoxicosis.

W. O. THOMPSON. Factors influencing operative mortality in thyrotoxicosis.

S. G. TAYLOR III. Pre-operative preparation

J. L. SPRACK. Surgical anatomy of the neck, cadaver demonstration

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S. Honore Street.

EVANGELICAL DEACONESS HOSPITAL

JOHN I. PERL. Stomach resection

GRANT HOSPITAL

KARL A. MEYER and DR. ABELIO. Operations and demonstration of cases

HOLY CROSS HOSPITAL

J. FRANCIS RUCIC. Cholecholestomy and dilatation of common duct, vaginal hysterectomy, cholecystectomy

J. FRANCIS RUCIC, D. DICICCO and WALTER EISEN. Resection of superior hypogastric ganglion

FRANCIS STREYSMAN. Variocelelectomy

J. SIMONAITIS. Pelvic laparotomy, inguinal oblique herniorrhaphy

J. KADZEWICK. Cholecystectomy

ILLINOIS MASONIC HOSPITAL

CHARLES H. PARKES, CARL F. STEINHOFF and WARREN E. PUGH. Surgical diabetes. Organization of the service, review of cases for past ten years' treatment, protamine

insulin anesthesia, operative and postoperative cases.

JOHN R. HARGER and J. WALTER JOHNSON. Gall bladder surgery, case history, taking evaluation of tests, operative technique, advantages of pendular anesthesia

JACKSON PARK HOSPITAL

GEORGE M. LUCAS. Operations.

LUTHERAN DEACONESS HOSPITAL

JOHN D. KOTICKY, G. H. MAMMEN and GEORGE H. SCHROEDER. Operations.

MERCY HOSPITAL

T. JOE. Surgical anatomy of thyroid gland

R. S. BERCHOFF. Cardiac complications in goiter

C. F. SCHAUB. Ophthalmic and laryngeal complications of goiter

L. D. MOORHEAD and K. KLOCHER. Surgical treatment of goiter

NORWEGIAN AMERICAN HOSPITAL

M. E. LICHTENSTEIN. Fractures and infections of the hand.

D. F. RUDNICK. Operative genito-urinary clinic, clinical conference, electrical resection of the prostate

PASSAVANT MEMORIAL HOSPITAL

Symposium. Diseases of the Endocrine Gland
HERMAN M. POMRENE. Relationship of vitamin A to thyroid disease

- RICHARD D WEBER Effect of unsaturated fatty acids on thyroid hyperplasia
 J E KEARNS, JR Discussion of exophthalmos in thyroid disease
 MARGARETE M KUNDE Pituitary obesity
 PAUL STARR Review of bio-assay procedures in clinical endocrinology

PRESBYTERIAN HOSPITAL

- V C DAVID C B DAVIS, WILLIAM MILLER and associates Operations
 Dry Clinic
 KELLOGG SPEED Incisional hernia treated by massive fascial transplant
 DR GATEWOOD Gastrojejunal ulcer
 ALBERT H MONTGOMERY Appendicitis in children
 FRANCIS STRAUS Echinosoccus disease of liver
 H OBERHELMAN Fibrocystic disease and carcinoma of breast
 LOUIS A ROSI Experimental vaccination of the peritoneum
 FRANK V THEIS Scaleneus anticus syndrome and cervical ribs demonstration of cases
 STANLEY LAWTON Malignancies of the breast in children

MICHAEL REESE HOSPITAL

- A A STRAUSS and S STRAUSS Gastro intestinal surgery
 D C STRAUS General surgery
 Thyroid Symposium
 D C STRAUS Group study and demonstration of thyroid records, surgical management of hyperthyroidism
 S SOSKIN The endocrine disturbance in thyroid disease
 L N KATZ Disturbed physiology of the cardiovascular system in thyroid disease
 M LEV Some clinical aspects of the heart in hyperthyroidism medical management of hyperthyroidism
 A S BOHNING and L N KATZ The electrocardiogram in thyroid disease
 W W HAMBURGER Arrhythmias in thyroid disease
 B PORTIS Outpatient clinic management of hyperthyroidism
 B PORTIS and H ROSE Treatment of hyperthyroidism complicated by pregnancy and syphilis
 R LEVINE Experimental treatment of hyperthyroidism

RESEARCH AND EDUCATIONAL HOSPITALS

- C B PUESTOW Operations Cholecholestomy carcinoma of rectum
 Symposium Gall Bladder Diseases
 C B PUESTOW The effect of cholecystectomy on pressure in the choledochus gall bladder fistulae
 EDMUND FOLEY Differential diagnosis between intrahepatic and extrahepatic jaundice
 W H COLE The role of cystic duct obstruction in gall bladder disease
 A HARTUNG The advantage of combining gastro intestinal series with cholecystography

ST ANTHONY DE PADUA HOSPITAL

- F B OLENTINE Operations and demonstration of goiter and abdominal surgery cases

ST JOSEPH'S HOSPITAL

- WILLIAM C BECK Thoracic surgery
 ARCHIBALD HOYNE Control of contagion in surgical diseases
 WILLIAM H G LOGAN Oral surgery
 FRANKLIN B MCCARTY Gall bladder surgery
 CHARLES M MCKENNA Undescended testicle
 HUGH MCKENNA Fractures, conservative surgery in diabetic gangrene

- FRANK THEIS Peripheral circulatory diseases
 Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES pathologist and WILLIAM F ANSPACH, radiologist

ST LUKE'S HOSPITAL

- F L McMILLAN Tumors of the colon
 H E MOCK Infected granuloma, gall bladder disease
 A R MORROW Acute surgical abdomen
 C E SHANNON Acute and chronic pancreatitis
 JOHN LINDQUIST Appendicitis
 JOHN PRIBBLE Atrial abscess

ST MARY OF NAZARETH HOSPITAL

- T LARKOWSKI Symposium Hernias and their repair
 J C HILL Discussion of pathologic operative findings

VETERANS ADMINISTRATION FACILITY

- PAUL F BROWN BENJAMIN F WARD JOSEPH E BARSS and MERRILL H JUDD Operations

WESLEY MEMORIAL HOSPITAL

- GUY S VAN ALSTYNE and FRANK L HUSSEY Management of breast tumors, comparative results in radical treatment of breast carcinoma with and without supplementary x ray therapy
 R W MCNEALY, R F HEDIN and E R STRAUSS Surgery of jaundiced patients

FRANCES E WILLARD HOSPITAL

- A E STEWART Clinic

WOMEN AND CHILDREN'S HOSPITAL

- PEARL M STETLER and MARIE ORTMAYER Gall bladder surgery in diabetics
 MARIE ORTMAYER The gastroscope and its indicated use
 ALICE CONKLIN Thyroidectomy
 ESTHER RABIN Repair of ventral hernia

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

- BENNETT R PARKER LEO M ZIMMERMAN WALTER S PRIEST and OTTO SAPHIR Symposium Thyroid disease
 FRANK WRIGHT, ALBERT ZRUNEK, LEO M ZIMMERMAN, M L WEINSTEIN and OTTO SAPHIR Symposium Blood transfusion

COOK COUNTY HOSPITAL

- RALPH BETTMAN and W A POTTS Operations
 E J LEWIS and E LATIMER Operations

HOLY CROSS HOSPITAL

- J FRANCIS RUZIC Biliary tract surgery
 F M PHIFER and G A INGLISH Renal surgery

MICHAEL REESE HOSPITAL

- Symposium Gastro Intestinal Surgery
 LEON BLOCH The medical treatment of ulcerative colitis
 A A STRAUSS The surgical management of ulcerative colitis
 S STRAUSS The use of ileostomy in ulcerative colitis and carcinoma of the colon
 OTTO SAPHIR Pathology of ulcerative colitis Discussion
 R ARENS X ray diagnosis of ulcerative colitis and peptic ulcer Discussion
 H NACHELES Physiology and pharmacology of peptic ulcer and ulcerative colitis
 A A STRAUSS and H F BINSWANGER Medical and surgical treatment of terminal ileitis

ST ANTHONY DE PADUA HOSPITAL

- W H BRADLEY Operations

ST BERNARD'S HOSPITAL

W S HECTOR and S S DEBOVY Imperforate anus with atresia of large bowel.

ST FRANCIS HOSPITAL

STAFF Symposium Pre-operative and post-operative care including diet fluid requirements, oxygen requirement, blood transfusion pulmonary complications thrombosis and phlebitis methods of decompression

ST LUKE'S HOSPITAL

H E JONES Reconstruction of the common duct.
LEE STROHL Appendicitis

ST MARY OF NAZARETH HOSPITAL

P CZWALINSKI Surgical incisions.
A PARTIPELO Aseptic gastro-intestinal anastomosis duodenal ileus motion picture demonstration
F TENCZAR Abdominal operations
JOHN TENCZAR and J C HILL Operations

WESLEY MEMORIAL HOSPITAL

HAYDEN E E BARNARD Cholecystography from surgical viewpoint.
NORMAN PARRY Mesenteric lymphadenitis

FRANCES E WILLARD HOSPITAL

OTIS M WALTER Clinic

WOMEN AND CHILDREN'S HOSPITAL

EMELIA GIKYOTAS Cholecystectomy hysterectomy oophorectomy

Friday Morning

ALBERT MERRITT BILLINGS HOSPITAL

D B PREMISTER L R DRAGSTEDT A BRUNSCHWIG
W F ADAMS and associates Operations
Symposium Surgery and the Circulation
H LIVINGSTONE Anesthesia and the circulation
N ROOME H WILSON H N HARETIS and D B PREMISTER Causes and treatment of surgical shock
W E ADAMS Intrathoracic operations and the circulation
KEITH GRIMSON Effects of partial and total sympathectomy on blood pressure

COLUMBUS HOSPITAL

M J SEIFERT and F A O'MALLEY Gastro-intestinal surgery
I F VOLINI Histidine treatment

COOK COUNTY HOSPITAL

VERNON C DAVID and MARK LORING Symposium Surgery of the large bowel
FREDERICK G DYAS and RICHARD MATTHIES Symposium Peritonitis with operative clinic
R C SULLIVAN and N T FRANCONA Operations
GEORGE AFFELBACH and H VOELK Operations
V C DAVID and MARK LORING Operations
LINDON SEED Operations
H JACKSON and PHILIP SHAPIRO Operations.
F J JIRKA and C SCUDERI Operations.
J D KOLCKY Operations.

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine 427 S Honore Street. J L SPRACK Gastro-enterostomy

GRANT HOSPITAL

SYLVAN COOMBS LINDON SEED and A G ZIMMERMAN Operations and demonstration of cases.

HOLY CROSS HOSPITAL

FRANK FRADDER and NICHOLAS PAYLETTIC Hysterectomy cesarean section cholecystectomy
ST PHIL BIEZIS Cholecystectomy hysterectomy repair of incisional hernia.
FELIX WINSKUNAS Inguinal herniorrhaphy
JAMES GALLAGHER Cholecystectomy
WILLIAM REILLY Cholecystectomy and appendectomy
M J BADZIMKOWSKI and H IRACE Hysterectomy

JACKSON PARK HOSPITAL

A BAMBERGER H H COV and C C CLARK Operations

LUTHERAN DEACONESS HOSPITAL

JOHN D KOLCKY G H MARKEE and GEORGE H SCHROEDER Operations.
GEORGE O SOLEM Surgical indications in peptic ulcer

MOUNT SINAI HOSPITAL

A A STRAUSS, S F STRAUSS and B SAYEL Operations.
M LEWISON Surgery in cardiovascular diseases.
H J ISAACS Coronary disease simulating acute abdominal catatrophies.
E B FREILICH Surgery in tuberculosis.
I DAVIDSON Clinical pathological conference.

POSTGRADUATE HOSPITAL

L ZIMMERMAN Varicose veins and their complications.

PRESBYTERIAN HOSPITAL

V C DAVID KELLONG SPEED C B DAVIS, DR GAYWOOD WILLIAM MILLER and A. H. MONTGOMERY Operations.

MICHAEL REESE HOSPITAL

J PATEJDL P SHAPIRO R CRAWFORD B PORTIS, S GARDENBERG M L PARKER and LEO ZIMMERMAN Operations.

RESEARCH AND EDUCATIONAL HOSPITALS

R B MALCOLM Operative clinic Neck dissection carcinoma of breast surgical pathology of breast tumors.
Clinical Demonstration
T J WACHOWSKI A ray treatment of carcinoma of the breast.
GEORGE DE TARNOWSKY Hemangiomas.
ARRIE BAMBERGER Ewing tumor with case report.
C L EIRCH Indications for splenectomy
W H COLE Acute pancreatitis.

ST ANTHONY DE PADUA HOSPITAL

J J SPRACK Abdominal surgery and demonstration.

ST ELIZABETH'S HOSPITAL

F D KATZELAGE Thyroid disease

ST LUKE'S HOSPITAL

Staff clinic, including papers, discussion and pathological demonstrations

SOUTH SHORE HOSPITAL

GUY S VAN ALSTYNE Aseptic bowel resection
J D KIRSCHBAUM Pathological demonstration.

Friday Afternoon

COOK COUNTY HOSPITAL

J G FROST and J M ROBERTS Operations.
SUMNER L KOCH and J J LEBOWITZ Symposium Hand infections with operative clinic.
E WARSZEWSKI and P CZWALINSKI Operations.

HOLY CROSS HOSPITAL

CHARLES GALANTI Osteogenic sarcoma.
EMIL WEISS Splenomegaly

ILLINOIS MASONIC HOSPITAL

CHARLES DRUECK and H E OLIVER Pruritis and cases due to systemic disturbances Ovarian dysfunction (various pruritus), hypothyroidism, spastic colon, obesity

JACKSON PARK HOSPITAL

HARRY E L TMM Operations

MOUNT SINAI HOSPITAL

I DAVIDSOHN Differential diagnosis of infectious mononucleosis simulating surgical conditions, demonstration of technique

RESEARCH AND EDUCATIONAL HOSPITALS

Symposium Diseases of the Gastro Intestinal Tract
GEORGE MILLES Pathology of carcinoma of stomach

W H COLE Total gastrectomy
T J WACHOWSKI X ray diagnosis of carcinoma of stomach
C L BIRCH Anemia associated with total gastrectomy
M H STREICHER Diagnosis of carcinoma of the rectum
C B PUESTOW Surgical treatment of carcinoma of the rectum
BERNARD PORTIS Surgical treatment of complicated duodenal ulcers
F L McMillan Regional ileitis
J L SPYACK Tuboovular stoma with particular reference to gastrostomy
H O WERNICKE The injection treatment of hernias

ST ELIZABETH'S HOSPITAL

J K NARAT Pre and postoperative intravenous administration of fat emulsion

GYNECOLOGY AND OBSTETRICS

Monday Afternoon

CHICAGO LYING IN HOSPITAL

Symposium Puerperal and Nonpuerperal Genital Infections

F L ADAIR Bacterial and antitoxic value of pyridium in urinary infections

I I BROWN Bacteriology of abdominal operations
R E ARNELL Gynecologic pelvic heat therapy (Elliott)
P W WOODRUFF Importance and treatment of oral and vaginal mycosis, prevention of infection in newborn—skin, mouth and cord

LUCILE HAC Sulfanilamide laboratory report
H C HESSELTINE Sulfanilamide therapy
Motion picture, "Normal Labor"

COOK COUNTY HOSPITAL

FREDERICK H FALLS Gynecological operations
A F LASH Puerperal sepsis ward walk

HOLY CROSS HOSPITAL

PAUL LAWLER Application of obstetrical forceps (manikin demonstration)

ST LUKE'S HOSPITAL

OBSTETRICAL STAFF Ward walk

WOMEN AND CHILDREN'S HOSPITAL

ANNIE E BLOUNT Gynecological operations Pyosalpinx ovarian tumor exhibition of 75 pound tumor

Tuesday Morning

CHICAGO LYING IN HOSPITAL

FRED L ADAIR, WILLIAM J DIECKMANN, M EDWARD DAVIS, H C HESSELTINE, CARL P HUBER, R E ARNELL and staff Operations and demonstration of cases

COOK COUNTY HOSPITAL

CAREY CULBERTSON and P H VANVERST Gynecological operations

A E KANTER Gynecological operations
D S HILLIS Ward walk, treatment of abortion

GRANT HOSPITAL

W A STUHR, E W FISCHMANN and FREDERICK H FALLS Operations and demonstration of cases

PRESBYTERIAN HOSPITAL

N S HEANEY CAREY CULBERTSON, A E KANTER E D ALLEN and H BOYSEN Operations

MICHAEL REESE HOSPITAL

J L BAER, J E LACKNER, WILLIAM RUBOVITS, I F STEIN and RALPH REIS Gynecological operations
JOSEPH L BAER Ward rounds
WILLIAM RUBOVITS Ward rounds

ST LUKE'S HOSPITAL

H O JONES and associates Demonstration clinic
W T CARLISLE Endometrial studies
ELGENE CARY Treatment of occipitoposterior

WESLEY MEMORIAL HOSPITAL

MARK T GOLDSTEIN, R A MASESSA, M J DiCOLA and W J JEFFERIS Uterine bleeding

FRANCES E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

MARY EDITH WILLIAMS Removal of abdominal tumors
OTILLIE ZELENY Electrocoagulation of the cervix uteri

Tuesday Afternoon

CHICAGO LYING IN HOSPITAL

Symposium Toxemias of Pregnancy

W J DIECKMANN Summary of five years' study
P W WOODRUFF Cold water test in pregnancy
R E ARNELL Vascular collapse
RUTH M WATTS Quantitative determinations of prolan and estrin in toxemia
EDITH L POTTER Pathology of toxemias of the mother and newborn

COOK COUNTY HOSPITAL

J P GREENHILL Gynecological operations
L RUDOLPH and J H BLOOMFIELD Symposium The toxemias of pregnancy

PASSAVANT MEMORIAL HOSPITAL

ARTHUR H CURTIS and GEORGE H GARDNER Operative and demonstration clinic

ST ELIZABETH'S HOSPITAL

J R LAVITER Cesarean section

FRANCIS E WILLARD HOSPITAL

ASCHER H GOLDFINE Clinic

WOMEN AND CHILDREN'S HOSPITAL

ELOISE PARSONS Vaginal hysterectomy and sterilization

Wednesday Morning

CHICAGO LYING IN HOSPITAL

FRED L ADAIR WILLIAM J DIECKMANN M EDWARD
DAVIS H C HESSELTINE CARL P HUBER R E
ARNELL and staff Operations and demonstration

COOK COUNTY HOSPITAL

C W BARRETT and R BARRETT Gynecological operations

J E FITZGERALD Demonstration Ward walk heart disease in pregnancy

J P GREENHILL C W BARRETT W T CARLISLE EGON
W FISCHMANN FREDERICK H FALLS A E KANTER
and CAREY CLIBERTSON Symposium Fibroids

EVANGELICAL DEACONESS HOSPITAL

A J SCHOENBERG Hysterectomy

GRANT HOSPITAL

W A STUBER E W FISCHMANN and FREDERICK H FALLS
Operations and demonstration of cases

HINOTIN HOSPITAL

E L CORNELL Postnatality

WILLIAM M HANRAHAN Comparison of various analgesias in labor

F L F STONE Sterility in the female

CHANNING W BARRETT Anatomy of pelvic floor

RUSSELL BARRETT Immediate repair of laceration

JACKSON PARK HOSPITAL

CHARLES F GREENE LOUIS H STERN W J NIXON
DAVIS JR and NORMAN ZOLLA Treatment of contracted pelvis by cesarean section version and forceps

NORWEGIAN AMERICAN HOSPITAL

P SNAPER Gynecological operations

ASSAUNT MEMORIAL HOSPITAL

GEORGE H CARDNER and ARTHUR H CURTIS Gynecological pathology—demonstration and conference

PRESBYTERIAN HOSPITAL

Dry Clinic

A E KANTER Changes in the upper urinary tract due to certain pelvic masses

EDWARD ALLEN Diagnosis and treatment of early ectopic pregnancy trichomonas vaginalis

FRED O PRIEST Hormone producing tumors

N SPROAT HEANEY Vaginal hysterectomy and endometriosis motion picture demonstration

CAREY CLIBERTSON Gross and microscopic demonstration of gynecological specimens

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS Eclamptic toxemia low cervical cesarean section under local anesthesia

W H BROWNE Progesterin in the treatment of abortion

G H REZER Modification of the Friedmann reaction

MICHAEL REISE HOSPITAL

JOSEPH L BAER Ward rounds

WILLIAM RUBOVITS Ward rounds

Dry Clinic

JOSEPH L BAER Shifting trends in the treatment of prolapse of the uterus

JULIUS E LACKNER Recent investigations in the action of progesterone

WILLIAM RUBOVITS Postoperative vaginal antiseptics

IRVING F STEIN Evaluation of the safe period

RALPH A REIS Mammography

LESTER F FRANKENTHAL JR Treatment of vulvovaginitis
MICHAEL L LEVENTHAL The Manchester operation for the cure of cystocele and prolapse

HENRY BUXBAUM The role of spermotoxin in temporary sterility

A F LASH Early diagnosis of carcinoma of the uterus

ST LUKE'S HOSPITAL

GEORGE C FINOLA Blood calcium during pregnancy

JAMES A GOLCH Chorionepithelioma

WASHINGTON BOULEVARD HOSPITAL

PAUL C FOX Sterility

WESLEY MEMORIAL HOSPITAL

CHARLES B REED WILLIAM B SERBIN and C C RICHARDSON Moving picture demonstration of low forceps breech extraction with forceps on aftercoming head spontaneous breech—manual aid

WOMEN AND CHILDREN'S HOSPITAL

MARY SPYACK Pelvic mensuration in prenatal care

FLORENCE HARR Prenatal care with reference to the baby

RUTH R DARROW Treatment of icterus gravis

BERTHA VAN HOOSER Maternal mortality

Wednesday Afternoon

CHICAGO LYING IN HOSPITAL

Symposium Obstetric Hemorrhage and Trauma of Mother and Fetus and Their Sequels

H C HESSELTINE Anatomy and physiology of the pelvic floor in relation to genital prolapse

M EDWARD DAVIS Pathology and treatment of placenta previa

W J DIECKMANN Role of blood transfusion in obstetric hemorrhage

C P HUBER Dührssen's incisions episiotomy repair of cervix and perineum

G T BURNS Uterine rupture

C J NEWCOMB Prevention and treatment of postpartum hemorrhage

Motion picture Hemorrhage Transfusion etc

CHICAGO MEMORIAL HOSPITAL

JALL M CLIVER JULIA C STRAWN HARRY L MEYERS

B E TUCKER and WALTER WIDBORG Plastic repair

JAMES E FITZGERALD WILLIAM F HEWITT GEORGE N

SCHIFF and HARRY BENARON Cesarean section

COOK COUNTY HOSPITAL

W T CARLISLE and C GEIGER Gynecological operations

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS and staff Operations Symposium Gynecological tumors

FREDERICK H FALLS Vulva carcinoma demonstration of cases vulvectomy under local anesthesia

R A LIFENDAHLE Solid tumors of ovary

L STONE Removal of ovarian cyst

H H HILL Early carcinoma of cervix

WOMEN AND CHILDREN'S HOSPITAL

CONSTANCE O BRITIS Gynecological operations

BERTHA VAN HOOSER and MAUDE HALL WENDELL Anesthesia in obstetrics

BEATRICE E TUCKER Perineal anesthesia

Thursday Morning

CHICAGO LYING IN HOSPITAL

FRED L ADAIR WILLIAM J DIECKMANN M EDWARD

DAVIS H C HESSELTINE CARL P HUBER R E

ARNELL and staff Operations and demonstration of cases

CHICAGO MEMORIAL HOSPITAL

PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS
BEATRICE E. TUCKER and WALTER WIBORG Symposium
The treatment of prolapse of the uterus, cystocele
and rectocele at various ages
JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N.
SCHIFF and HARRY BEVARON Indications and technique
for cesarean section nerve block in obstetrics

COLUMBUS HOSPITAL

C. W. BARRETT and R. BARRETT Gynecological clinic

COOK COUNTY HOSPITAL

EGON W. FISCHMANN and W. J. REICH Gynecological
operations
J. L. FITZGERALD and L. RUDOLPH Symposium Ectopic
pregnancy its diagnosis and treatment

GRANT HOSPITAL

W. A. STUHR, L. W. FISCHMANN and FREDERICK H. FALLS
Operations and demonstration of cases

ILLINOIS MASONIC HOSPITAL

HAROLD W. MILLER, WALTER C. BORSMER and GLENN
NELSON Breast tumors—early diagnosis demonstra-
tion of cases Operative Uterine fibroid differential
diagnosis, demonstration of peritoneoscopy
FREDERICK O. BOWE, BEULAH WALLIN and JOHN H.
GILMORE Cesarean section Indications comparison of
results in different types, demonstration of operative
technique of low cesarean section extra uterine preg-
nancy, frequency diagnosis complications and treatment

MOUNT SINAI HOSPITAL

A. H. KLAUWINS Endometriosis
A. E. KANTER Masculinizing tumors of ovary
A. F. LASH Pelvic infections
A. H. E. GOLDFINE, C. NEWBERGER, H. BLAUBAUM and
associates Symposium Obstetrical hemorrhages
L. RUDOLPH Physiological and clinical aspect of occipito
posterior position
A. ARKIN, I. A. RABENS and R. GORDON Medico-surgical
discussion

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D.
ALLEN and H. BOYSEN Operations

MICHAEL REESE HOSPITAL

JOSEPH L. BAER Ward rounds
WILLIAM RUBOVITS Ward rounds

ST. ANTHONY DE PADUA HOSPITAL

M. A. WEISSKOPF Operations

ST. LUKE'S HOSPITAL

H. K. GIBSON The late toxemias of pregnancy

SOUTH SHORE HOSPITAL

ANDREW DAHLBERG The management of occipitoposterior
position

WESLEY MEMORIAL HOSPITAL

MARIE T. GOLDSTONE, R. A. MASESSA, M. J. DiCOLA and
W. G. JEFFRIES Vaginal plastics

Thursday Afternoon

CHICAGO LYING IN HOSPITAL

Symposium Obstetric and Gynecologic Pathology
C. J. NEWCOMB Malignancy of the vulva
F. L. ADAIR Treatment of genital malignancy cases

EDITH L. POTTER Pathologic lesions peculiar to fetus and
newborn

M. E. DAVIS Pathology and treatment of uterine
fibromyomata

RUTH M. WATTS Endocrinologic study of ovarian cysts

M. W. BOYNTON Pathology and treatment of hydatidiform
mole and chorionepithelioma
Motion picture "Colpocleisis"

COOK COUNTY HOSPITAL

FREDERICK H. FALLS Gynecological operations
J. H. BLOOMFIELD and D. S. HILLIS Symposium Late
hemorrhages of pregnancy

PASSAVANT MEMORIAL HOSPITAL

ARTHUR H. CURTIS and GEORGE H. GARDNER Operative
and demonstration clinic

ST. BERNARD'S HOSPITAL

E. A. RACH and F. J. STUCKER Cesarean section
S. S. SCHOCHET Fibroids
H. B. HAEBERLIN Hysterectomy and its indications

ST. MARY OF NAZARETH HOSPITAL

L. KOZAKIEWICZ and M. UZNAWSKI Recent advances in
toxemias of pregnancy
H. LITTLE, GEORGE MUELLER and J. C. HILL Ovarian
tumors

Friday Morning

CHICAGO LYING IN HOSPITAL

IRENE L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD
DAVIS, H. C. HESSELTINE, CARL P. HUBER, R. E.
ARNELL and staff Operations and demonstration of
cases

COOK COUNTY HOSPITAL

A. E. KANTER Gynecological operations
CAREY CULBERTSON and F. H. VANVERST Gynecological
operations
A. F. LASH Demonstration Ward walk toxemias of
pregnancy

GRANT HOSPITAL

W. A. STUHR, E. W. FISCHMANN and FREDERICK H. FALLS
Operations and demonstration of cases

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D.
ALLEN and H. BOYSEN Operations

MICHAEL REESE HOSPITAL

J. L. BAER, J. E. LACKNER, WILLIAM RUBOVITS, I. F.
STEIN and RALPH REIS Gynecological operations
JOSEPH L. BAER Ward rounds
WILLIAM RUBOVITS Ward rounds

ST. LUKE'S HOSPITAL

JAMES E. FITZGERALD Heart disease in pregnancy

WESLEY MEMORIAL HOSPITAL

C. B. REED and W. B. SERBIN Ablatio placenta
G. C. RICHARDSON Placenta praevia

WOMEN AND CHILDREN'S HOSPITAL

BERTHA VAN HOOSEN and MAUDE HALL WINNETT Surg-
ical cases complicating obstetrics

Friday Afternoon

CHICAGO LYING IN HOSPITAL

Endocrines and Physiology of Female Genitalia
M. W. BOYNTON Laboratory diagnosis of pregnancy
A. PROSTROFF Circulation of the placenta

SARAH A PEARL Studies on uterine motility
C P HUBER Diagnosis of endocrine disorders
M E DAVIS Clinical treatment of endocrine disorders
CHARLOTTE L CLANCY Contraception and sterilization
Motion picture 'Caesarean Section'

COOK COUNTY HOSPITAL

L RUDOLPH Symposium Prolonged labor constriction
ring dystocia
D S HILLIS J H BLOOMFIELD and A F LASH Demon-
stration and operations symposium Caesarean section

MERCY HOSPITAL

HENRY SCHMITZ HERBERT E SCHMITZ HENRY L SCHMITZ
and P A NELSON Symposium on operative gynecology

RLSFARCHI AND EDUCATIONAL HOSPITALS

FREDERICK H FALLS and staff Symposium Plastic
operations with special reference to the use of local
anesthesia
FREDERICK H FALLS Vaginal hysterectomy for proci-
dentia under local anesthesia
M J SCHNEVERLIE Anterior colporrhaphy and interposi-
tion operation under local anesthesia
WILLIAM H BROWNE Sturmdorf Kelly incontinence oper-
ation and perineorrhaphy under local anesthesia

WOMEN AND CHILDREN'S HOSPITAL

CATHERINE TRUE Abdominal gynecological cases Uterine
fibroids tumor of vagina
OTILLIE ZELEVNA Cervical lesions before and after treat-
ment with electrocoagulation
ELOISE PARSONS Treatment of eroded cervix by cautery
treatment of sterility hysterosalpingography

ORTHOPEDIC SURGERY

Monday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

H B THOMAS F W HARK and C N LAMBERT Sym-
posium Tenodesis Operations and demonstration of
cases tendon transplantation

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Spondylo-
listhesis aseptic necrosis of the head of the femur
SHRINER'S HOSPITAL FOR CRIPPLED CHILDREN
BEVERIDGE MOORE Boys ward walk
H A SOFIELD Girls ward walk
A DREHER Apparatus and special instruments

Tuesday Morning

CHILDREN'S MEMORIAL HOSPITAL

F CHANDLER F SEIDLER C PEASE and J NORCROSS
Operations and demonstration of cases Sympathicoblas-
toma spondylolisthesis pytelar advancement opera-
tion hip fusion Legg Perthes's disease extraperitoneal
obturator neurectomy congenital dislocation of hip,
Pott's disease developmental anomalies coxa valga

COOK COUNTY HOSPITAL

ARTHUR CONLEY and C GUY Operations and demon-
stration of cases Blind pegging of hip for fracture of neck
of femur using Kirschner wire and Smith Petersen nail
problems in diagnosis of bone tumors painful back in
medico legal cases persistent dizziness following head
injuries fractures in and about the ankle
MARCUS H HOBART and F JANSEY Demonstration with
operative clinic Removal of internal semilunar cartilage
recurrent dislocations of the shoulder internal derange-
ment of the knee joint pinal fu ions and low back pain
acquired dislocations of hip following scarlet fever
syndactylism

PASSAVANT MEMORIAL HOSPITAL

PHILIP H KREUSCHER and RICHARD J BENNETT JR
Spinal fusion Nicola operation for recurrent dislocation
of shoulder osteochondritis of elbow joint osteochon-
dromatosis of hip joint

MICHAEL REESE HOSPITAL

PHILIP LEWIS DANIEL LEVINthal CHARLES PEASE
F GLASSMAN SIDNEY SIDEMAN JEROME G FINDER and
I WOLFF Operations

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Chordotomy
for chorio-athetosis spina bifida
SHRINER'S HOSPITAL FOR CRIPPLED CHILDREN
BEVERIDGE MOORE and H A SOFIELD Operations

Tuesday Afternoon

COLUMBUS HOSPITAL

FREDERICK MUELLER C H SLOTT and I E SLOTT
Sciatica

MOUNT SINAI HOSPITAL

C JACOBS Orthopedic demonstrations
L MILLER Visualization of joints
J FINDER Giant cell tumor of bone
F GLASSMAN Nonunion of neck of femur

PASSAVANT MEMORIAL HOSPITAL

EMIL HAUSER and associates Surgery of the knee and
foot—demonstration of cases and lantern slides Total
tendon transplant for slipping patella injuries of the
external semilunar cartilage loose body the result of a
semilunar cartilage injury manipulative correction of
deformity tendon transplant as a routine procedure to
triple arthrodesis of the paralytic foot reconstruction
operation for hallux valgus

PRESBYTERIAN HOSPITAL

E J BERKHEISER KELLOGG SPEED D RIDER and WILLIS
POTTS Operations

ST LUKE'S HOSPITAL

H A SOFIELD Fracture of the neck of the femur treated
by steel pin method of fixation Lantern slides cases
E W RYERSON Injuries and anomalies of the spine
R O RITTER Fractures and infantile paralysis

WESLEY MEMORIAL HOSPITAL

FELIX JANSEY Bone and joint surgery diagnosis of
shoulder lesions
HAMPAR KELIKIAN Fractures of the forearm

Wednesday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VETIAK Indications for surgical treatment of
arthritis

ST LUKE'S HOSPITAL

E W RYERSON and associates Operations

Wednesday Afternoon

EVANSTON HOSPITAL

J L PORTER and R C LONERGAN Low back disorders
 MARCUS HOBART Operative treatment of low back pain
 DWIGHT CLARK Fractures about the knee joint

MERCY HOSPITAL

L D CLARIDGE and J M LEONARD Unusual problems in orthopedic and traumatic surgery

MUNICIPAL TUBERCULOSIS SANITARIUM

E J BERKHEISER and ISADORE ZAPOLSKY Demonstration in bone and joint tuberculosis

PRESBYTERIAN HOSPITAL

E J BERKHEISER KELLOGG SPEED D RIDER and WILLIS POTTIS Operations

MICHAEL REESE HOSPITAL

PHILIP LEWIS Fracture problems new approach for arthrodesis of knee joint, discussion of bone tumors motion picture demonstration of manipulative surgery
 SIDNEY SIDEMAN Rice bodies in tendon sheath of the hand, Hoke stabilization of the foot spastic paralysis roentgenologic library of the hip joint, fusion operation in tuberculosis of the knee joint bunion operation, multiple cartilaginous exostosis

DANIEL H LEVINTHAL and IRVING WOLIN Tendon transplantation in poliomyelitis spastic paralysis recurrent dislocation of shoulder, flat feet demonstration of arthroplasties of the knee, hip and elbow, knee joint surgery

CHARLES PEASE Acute transverse atrophy of bone traumatic rupture of intervertebral disc, reduction of compression fracture of spine osteochondromatosis of the elbows

JEROME G FINDER Chondromyxosarcoma, two cases, flexorplasty of the thumb for paralytic opponents pollicis osteochondroma of the tibia McBride bunion plasty, unusual bone tumor (?) of femur Key operation for soft corns, spastic paralysis—bilateral adductor tenotomy and obturator nerve neurectomy, case with unusual deformities

FRANK GLASSMAN Fracture and dislocation of shoulder, supracondylar fracture of the humerus, fracture of the neck of the femur complete fracture of the tibia and fibula removal of the head of the radius three cases, osteoma of the femur, demonstration of various types of fractures and treatment

ST ANTHONY OF PADUA HOSPITAL

THOMAS DWYER New bone biopsy trephine pathological specimens

ST LUKE'S HOSPITAL

H B THOMAS, FRED HARR and CLAUDE LAMBERT Whitman's reconstruction of the hip good range of motion Volkman's contracture a plea for early treatment echinococcus cyst of the os ilium chronic arthritis joints arthroplasty

SHRINER'S HOSPITAL FOR CRIPPLED CHILDREN

BEVERIDGE MOORE and LAWRENCE NOALL Congenital club feet treatment

A DREHER New types of braces

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Bone and Joint Surgery

E L COMPERE Leg lengthening operation, technique and results, spinal fusion in the correction of scoliosis

C H HATCHER The pathology and treatment of tuberculous arthritis, studies in the rate of skeletal growth and equalization of limb length

P C BUCY and R B CLOWARD Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis

C B HUGGINS Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton

H N HARRIS Bone graft for ununited fracture

COOK COUNTY HOSPITAL

PHILIP LEWIN and S SIDEMAN Demonstration and operative clinic Tunnel skin graft over os calcis, spondylolisthesis, stabilization of paralytic varus foot, arthrodesis of ankle joint, Hallux varus tuberculous spine—fusion, infantile paralysis, low back pain with sciatica

FRANK G MURPHY Demonstration Skin grafts for old wounds of leg unusual bone tumors, fracture into ankle joint, malunion of Colles' fracture, tuberculosis of cuneiform bone, scar contracture of forearm—skin graft

DANIEL H LEVINTHAL and I WOLIN Demonstration Motion pictures—surgical treatment of spastic paralysis, surgical treatment of residual paralysis following polio myelitis Operations Bone graft for nonunion, stabilization, benign bone tumors

PHILIP H KREUSCHER and R T McDONALD Demonstration with operations Nicola operation, semilunar cartilage derangement spinal grafts, new operation for hip fusion new operation for knee fusion

MICHAEL REESE HOSPITAL

PHILIP LEWIN, DANIEL LEVINTHAL, CHARLES PEASE, F GLASSMAN, I WOLIN, SIDNEY SIDEMAN and JEROME G FINDER Operations

ST BERNARD'S HOSPITAL

S L GOVERNALE Pseudomuscular dystrophy, case demonstration

J G FROST Metastatic hypernephroid carcinoma of the femur

CHESTER C GUY Surgical pathology of bone tumors

ST FRANCIS HOSPITAL

E B FOWLER Orthopedic and traumatic surgery

ST LUKE'S HOSPITAL

E W RYERSON and associates Clinic

ST MARY OF NAZARETH HOSPITAL

L CZAJA Symposium Late results of fractures, clinic

SHRINER'S HOSPITAL FOR CRIPPLED CHILDREN

BEVERIDGE MOORE and H A SOFIELD Operations

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON, A T BARNETT and M J MURPHY Massive bone graft of femur, release of iliotibial band for severe sciatica

Thursday Afternoon

COOK COUNTY HOSPITAL

F J BERKHEISER and F SHAPIRO Operative clinic with demonstration Spondylolisthesis, anterior poliomyelitis, arthrodesis and tendon transplantation

ILLINOIS MASONIC HOSPITAL

CHARLES N. PEALE and EDGAR WHITE Fractures about the elbow in children reduction of fractures of the spine traumatic rupture of the intervertebral disc

PRESBYTERIAN HOSPITAL

Dry Clinic

KELLOGG SPEED Displaced intervertebral disc arthroplasty of elbow epiphysitis of upper end of femur tendoplasty for wrist drop extra articular arthrodesis of hip joint for varying indications Brackett reconstruction operation for ancient ununited fractures of neck of femur fractures of carpal navicular bone delayed and nonunions treated by different methods treatment of adherent patella by massive fat transplantation interphalangeal fracture dislocations treated by different methods

D RIDER Club feet reconstruction of hand bilateral knock knees drop joint or baseball fingers

WILLIS POTTS Nail fixation in fractures of neck of femur

RESEARCH AND EDUCATIONAL HOSPITALS

H B THOMAS F W HARK and C N LAMBERT Operation Shelving of a congenital dislocated hip Demonstration of patients with closed reduction open reduction and shelving of congenital dislocation

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Bone tumors—presentation of photographs of unusual cases

Friday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VRTIAK Indications for surgical treatment of arthritis

Friday Afternoon

PRESBYTERIAN HOSPITAL

F J BERKHEISER KELLOGG SPEED D RIDER and WILLIS POTTS Operations

ST LUKE'S HOSPITAL

F A CHANDLER and JOHN R NORCROSS Knee fusion giant cell tumor of spine cyst of femur

SHRINER'S HOSPITAL FOR CRIPPLED CHILDREN

BEVERIDGE MOORE End results of leg lengthenings, deltoid transplant

VETERANS ADMINISTRATION FACILITY

S K LIVINGSTON Symposium Maggot treatment of osteomyelitis—review of 1100 treated cases.

FRACTURES AND TRAUMATIC SURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

WILLIAM R CUBBINS and J J CALLAHAN Operative fracture clinic ward walk

JACKSON PARK HOSPITAL

S W M ROBINSON C W HENMAN M J MILLS and FRANK G MURPHY Traumatic surgery

ST ANTHONY DE PADUA HOSPITAL

F W SLOBE Fractures phases of traumatic surgery

ST LUKE'S HOSPITAL

HART E FISHER Electrical injuries shock burns and glare injury to the eyes with their preventive phases treatment resuscitation etc Evolution of resuscitation showing various methods from ancient time down to the present Manual mechanical and medical methods Lantern slide and motion picture demonstration

T HANSON and J JANSEN Treatment of comminuted fracture of the leg

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

ARTHUR H CONLEY and S PERRY ROGERS Symposium Blind pegging of fractures of the femur
FRED MILLER T C BROWNING, EMILE DUVAL and G M LANDAU Fracture of both bones of lower leg

COOK COUNTY HOSPITAL

WILLIAM R CUBBINS and J J CALLAHAN Fracture ward walk

ST LUKE'S HOSPITAL

H E MOCK A R MORROW and C E SHANNON Skull fracture exhibit

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R METZ Treatment of unusual fractures

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

C R G FORRESTER HORACE STEINSON and A H MASON Symposium Nerve repair

COOK COUNTY HOSPITAL

SUMNER L KOCH and J J LEBOWITZ Symposium Tendon and nerve suturing of the hand with operative clinic

PRESBYTERIAN HOSPITAL

F J BERKHEISER KELLOGG SPEED D RIDER and WILLIS POTTS Operations

ST LUKE'S HOSPITAL

K R DUFF and R R DUFF JR The use of adhesive plaster in the treatment of burns, simple traction in dislocations of the shoulder elbow and Colles fracture

Wednesday Morning

COOK COUNTY HOSPITAL

WILLIAM R CUBBINS and J J CALLAHAN Fracture ward walk

FREDERICK DYAS and RICHARD MATTHEWS Fracture ward walk (female)

ST FRANCIS HOSPITAL

W E REDLICH Fractures of the jaw presentation of cases lantern slides

ST LUKE'S HOSPITAL

H E MOCK A R MORROW and C E SHANNON Skull fracture exhibit

JOHN D FALLIS Treatment of traumatic back injuries.

SOUTH SHORE HOSPITAL

FRANK G MURPHY Skeletal traction and lower extremity fractures fracture of neck of the femur subtrochanteric osteotomy

Wednesday Afternoon
COLUMBUS HOSPITAL

L. BEECHER and F. LAGORIO Traumatic surgery

COOK COUNTY HOSPITAL

JAMES J. CALLAHAN, CARLO S. SCUDERI, FREDERICK DYAS
 and GEORGE L. APPELBACH Symposium Knee joint
 injuries

PASSAVANT MEMORIAL HOSPITAL

On the Spot" Symposium on Fractures of the
 Neck of the Femur

Planned as a complete discussion of one subject. The
 speakers will not present formal papers but prior to their
 appearance will be furnished with a list of questions re-
 garding their methods of technique. The audience will
 have this list of questions in their hands.

PAUL B. MAGNUSON Various problems concerned in the
 selection of a method, and prognosis in various types of
 fractures of the neck of the femur.

W. EUGENE WOLCOTT Des Moines, Iowa The circulation
 in the neck of the femur and its effect upon prognosis.

GUY W. LEADBETTER, Washington, D. C. Closed reduc-
 tion by Leadbetter method followed by immobilization
 in cast, Whitman position. Types of individuals and of
 fractures to which this method is best suited.

LAWSON THORNTON and CALVIN SANDISON Atlanta, Ga.
 Smith Petersen three flange nail with modifications its
 advantages and disadvantages in use and application in
 various types of fractures of the neck of the femur.

AUSTIN T. MOORE, Columbia, S. C. Fixation of fractures
 of neck of femur use of Moore nails description of tech-
 nique with difficulties and advantages of this method.

WILLIAM R. CUBBINS and JAMES J. CALLAHAN Two flange
 nail, its method of application, technique and success
 and failure.

ROGER ANDERSON, Seattle, Wash. The well leg traction
 splint, technique of application, its advantages and dis-
 advantages in various types of cases.

JAMES K. STACK Brackett operation in fresh fractures,
 selection of cases in which good results may be expected
 and the contra indications for its selection as a means of
 treatment.

PRESBYTERIAN HOSPITAL

E. J. BERKHEISER, KELLOGG SPEED, D. RIDER and WILLIS
 POTTS Operations

ST LUKE'S HOSPITAL

C. G. SHEARON and GRAHAM KERNWEIN Infections of
 the hand

Thursday Morning

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and J. J. CALLAHAN Fracture ward
 walk

GARFIELD PARK COMMUNITY HOSPITAL

J. J. CALLAHAN Diagnosis and treatment

H. N. WAIT X-ray diagnosis

MILTON SCHMITT Physiotherapy in fracture work

HENROTIN HOSPITAL

JOHN A. GRAHAM Fractures of the lower end of the radius,
 lantern slides, discussion by ARTHUR R. HANSEN Treat-
 ment of nerve injuries in traumatic surgery.

JOHN J. EICHSTAEDT Fractures of humerus treated with
 the use of airplane splints

MAURICE A. BERNSTEIN Newer phases of internal de-
 rangement of the knee joint

RALPH KORDENAT Cancer of male breast

JACKSON PARK HOSPITAL

ARRIE BAMBERGER Demonstration clinic

ST JOSEPH'S HOSPITAL

HUGH MCKENNA Demonstration clinic

ST LUKE'S HOSPITAL

H. E. MOCK, A. R. MORROW and C. E. SHANNON Skull
 fracture exhibit

H. E. MOCK and associates Hip fracture demonstration

WILL LYON Early closure of open wounds

ST MARY OF NAZARETH HOSPITAL

L. CZAJA Symposium Late results of fractures, clinic

U S MARINE HOSPITAL

HORACE P. STIMSON Ununited fractures with osteo-
 myelitis

E. C. LUTTON and R. W. FLYNN Skeletal traction and
 countertraction in treatment of fractures

FRANCES E. WILLARD HOSPITAL

JAMES A. VALENTINE Clinic

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

ARTHUR H. CONLEY and S. PERRY ROGERS Blind pegging
 of fractures of the femur

FRED MILLER, T. C. BROWNING, EMILE DUVAL and G. M.
 LANDAU Fracture of both bones of lower leg

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and J. J. CALLAHAN Demonstra-
 tion Operative fractures

GEORGE APPELBACH Fracture ward walk (female)

WILLIAM R. CUBBINS Operative fracture clinic

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENNAN, M. J. MILLS and
 FRANK G. MURPHY Traumatic surgery

PRESBYTERIAN HOSPITAL

Dry Clinic

KELLOGG SPEED Displaced intervertebral disc, arthro-
 plasty of elbow epiphysitis of upper end of femur,
 tendoplasty for wrist drop extra articular arthrodesis of
 hip joint for varying indications Brackett reconstruction
 operation for ancient ununited fractures of neck of femur,
 fractures of carpal navicular bone, delayed and non-
 unions, treated by different methods, treatment of
 adherent patella by massive fat transplantation, inter-
 phalangeal fracture dislocations, treated by different
 methods

D. RIDER Club feet, reconstruction of hand, bilateral
 knock knees, drop joint or baseball fingers

WILLIS POTTS Nail fixation in fractures of neck of femur

FRANCES E. WILLARD HOSPITAL

FRED CARLS Clinic

WOMEN AND CHILDREN'S HOSPITAL

ARMINA HILL Minor injuries

MARY E. WILLIAMS Fractures, dislocations

Friday Morning

CHICAGO MEMORIAL HOSPITAL

C R G FORRESTER HORACE STIMSON and A H MASON
Fracture

COOK COUNTY HOSPITAL

DR. CATWOOD and S LAWTON Symposium Fractures in children with operative clinic
WILLIAM R CLIBBING and J J CALLAHAN Fracture of low up clinic case demonstrations

NORWEGIAN AMERICAN HOSPITAL

H A SOFIELD Demonstration of technique and presentation of results of the treatment of oblique fractures of the tibia and fibula with a simplified turnbuckle and pin apparatus clinical conference demonstration of technique and presentation of results of 50 cases of hip fractures treated by steel pin fixation

ST BERNARD'S HOSPITAL

R S WESTLINE and E L ARENDORF Fractures of the wrist joint

L B DONALE and M E CREIGHTON Fractures of the shaft of the femur

ST LUKE'S HOSPITAL

H E MOCA A R MORROW and C E SHANNON Skull fracture exhibit

Friday Afternoon

COLUMBUS HOSPITAL

F MUELLER L PECHER and F LAGORTO Clinic
W L BEECHER Traumatic surgery

COOK COUNTY HOSPITAL

JAMES J CALLAHAN and CARLO S SCUDERI Cadaver demonstrations

PRESBYTERIAN HOSPITAL

E J BERENHEIMER KELLOGG SPEED D RIDER and WILLIS POTTS Operations

GENITO-URINARY SURGERY

Monday Afternoon

COLUMBUS HOSPITAL

WILLIAM GEHL FRANK L CHENOWETH and H E DAVIS
Resectoscope for bladder carcinoma

Tuesday Morning

MOUNT SINAI HOSPITAL

H ROBINCK H SOLOWAY and E HIRSCH Symposium
Tumors of the kidney

PASSAICANT MEMORIAL HOSPITAL

Symposium Tuberculosis of the Genito-Urinary Tract
A I LESPINASSE Tuberculosis of the epididymis
FREDERICK LIEBERTHAL Pathogenesis of renal tuberculosis
L L VESEEN Surgery and postoperative management of renal tuberculosis

PRESBYTERIAN HOSPITAL

HERMAN L KRETSCHMER ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

I KOLL J EINSTEADT H ROBINCK I SHAPIRO J GROVE I LIEBERTHAL and A E JONES Symposium
Carcinoma of the urinary bladder

ST MARY OF NAZARETH HOSPITAL

J WELFELD Urologic clinic Malignancy of tumors of the bladder in children lantern slides specimens histories

SOUTH SHORE HOSPITAL

LOUIS D SMITH The management of vesical neck obstruction

WESLEY MEMORIAL HOSPITAL

V D LESPINASSE Sterility

WOMEN AND CHILDREN'S HOSPITAL

MARIE ORTMAYER PEARL M STETLER and SOPHIE NOWAKOWSKA Pyonephrosis with a dumbbell tumor of the spinal cord renal and ureteral calculi

Tuesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

C M MCKENNA R D HERROLD and staff Operations
Undescended testicle hypospadias hydronephrosis
nephropexy Demonstrations Experimental and clinical studies on various types of urinary antiseptics
genito urinary anomalies with special reference to undescended testicle and hypospadias

ST ANTHONY DE PADUA HOSPITAL

O J JESSA Prostatic management carcinoma of bladder
pyelography

Wednesday Morning

CHICAGO MEMORIAL HOSPITAL

J WILLIAM PARKER and JOHN P O'NEIL Clinic

COOK COUNTY HOSPITAL

HARRY CULVER and M J BAKER Operations
L L VESEEN and A MCNALLY Operations
CHARLES MCKENNA and E EBERT Operations
HARRY ROBINCK and H M SOLOWAY Operation

GARFIELD PARK COMMUNITY HOSPITAL

VINCENT J O'CONNOR and HAROLD D DANKERTZ Problems of nephropexy and upper urinary tract obstruction associated with malposition of kidneys including anomalies operation lantern slides and motion picture illustrating the operative technique

MERCY HOSPITAL

H E LANDES BEN FILLES and J W FENLIN Symposium
Transurethral resection
J E LAINE and P H MCNULTY Kidney anomalies, treatment of neoplasms of urinary tract

MUNICIPAL TUBERCULOSIS SANITARIUM

DORRIN RUDNICK and REBEY HILFANTZ Nephrectomy for renal tuberculosis demonstration of inoperable cases postoperative results one to five years including pyelograms chest plates and pathological specimens

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTADT, H. ROLNICK, I. SHAPIRO, J. GROVE, F. LIEBERTHAL and A. E. JONES Operations

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL

J. WILLIAM PARKER, JOHN P. O'NEIL, E. J. STIEGLITZ,
D. G. BRUNJES OTTO SAPHIR and GEORGE M. LANDAU
Symposium Kidney infections
M. L. WEINSTEIN, J. WILLIAM PARKER and JOHN P.
O'NEIL Transurethral resection of the prostate
R. A. MELENDY, J. WILLIAM PARKER, JOHN P. O'NEIL and
OTTO SAPHIR Tuberculosis of urinary tract in males

COOK COUNTY HOSPITAL

L. L. VESEEN, A. McNALLY, H. ROLNICK and H. M.
SOLOWAY Symposium Pyogenic infection of the upper
urinary tract with operative clinic

ST. BERNARD'S HOSPITAL

ANDREW SULLIVAN Clinic

ST. ELIZABETH'S HOSPITAL

T. G. McDougall Carcinoma of the bladder

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL

HERMAN L. KRETSCHMER and K. BARBER Operations
HERMAN L. KRETSCHMER Urological conditions in infants
and children

COOK COUNTY HOSPITAL

HARRY CULVER W. J. BAKER, CHARLES McKENNA and
E. EWERT Symposium Chronic bladder neck obstruc-
tions in the male with operations

GARFIELD PARK COMMUNITY HOSPITAL

CLARENCE C. SAEHLHOF Carcinoma of bladder, diagnosis,
type of treatment and approach result cases, renal
calculi, multiple stone in reduplicated pelvis, diagnosis,
treatment by heminephrectomy, operative cases, malig-
nancy of prostate gland diagnosis method of immediate
relief of obstructive symptoms, postoperative radiation
therapy results and show cases seminoma of testes,
incarceration of undescended testes, operation, micro-
scopic diagnosis, irradiation

JACKSON PARK HOSPITAL

WILLIAM YONKER Transurethral prostatic resection com-
pared to other types of prostatic surgery

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates
Operations

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTADT, H. ROLNICK, I. SHAPIRO, J.
GROVE, F. LIEBERTHAL and A. E. JONES Operations

ST. FRANCIS HOSPITAL

BEN E. FILLIS Presentation of cases

ST. LUKE'S HOSPITAL

L. E. SMITH, HARRY CULVER and associates Genito-
urinary clinic Urinary calculi

WASHINGTON BOULEVARD HOSPITAL

VINCENT J. O'CONNOR Plastic on renal pelvis for hy-
dronephrosis review of various types of hydronephrosis
with exhibition of films and pathologic specimens

WESLEY MEMORIAL HOSPITAL

V. D. LESPINASSE and associates Prostatic disease

Thursday Afternoon

VETERANS ADMINISTRATION FACILITY

T. G. McDougall Carcinoma of the bladder, diagnosis
and treatment—surgical and irradiation

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

PAUL MORF Nephrolithotomy

ILLINOIS MASONIC HOSPITAL

EDWARD W. WHITE, ROBERT H. HAYES and JOHN H.
GILMORE Renal tuberculosis Avenues of transmission,
discussion of the pathogenesis and morbidity, primary
foci and complicating factors in relation to general
tuberculosis roentgenological aspects concerning pro-
static resection

CLARENCE C. SAEHLHOF, JOHN H. GILMORE and JOHN
PISNOTTA Carcinoma of bladder—diagnosis, type of
treatment and approach result cases, renal calculi—
multiple stone in reduplicated pelvis, diagnosis treat-
ment by heminephrectomy, operative cases, malignancy
of prostate—diagnosis, method of immediate relief for
obstructive symptoms postoperative radiation therapy
and results, cases, roentgenological advances in urologic
diagnosis

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, R. HERBST, C. WELLER, G.
BAUMRUCKER, J. MERRICKS and K. GERMAN The
present status of transurethral resections in the treat-
ment of bladder neck obstructions, elusive ulcer of the
bladder surgical accidents during resection of prostate
gland renal cysts dilatation and injection of ejaculatory
ducts in treatment of seminal vesiculitis differential
diagnosis of bone metastases in carcinoma of prostate
gland renal calculi neuromuscular dysfunction of upper
urinary tract bladder neck obstruction in women

VETERANS ADMINISTRATION FACILITY

T. G. McDougall, J. R. RIMMER and FREDERICK K.
HANTOCH Perineal prostatectomy

Friday Afternoon

ILLINOIS MASONIC HOSPITAL

C. OTIS RITCH and E. D. LEVISOHN Nephrectomy,
transurethral prostatic resection anomalies of upper
urinary tract, bilateral and unilateral complete re-
duplication of kidneys and ureters, incomplete redupli-
cation of kidneys and ureters, bifid pelvis, ureteral buds,
renal tuberculosis

THORACIC SURGERY

Monday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM

Collapse Therapy Clinic 23 N Wacker Drive

STAFF Demonstration of collapse therapy measures on ambulatory patients discussion of indications results complications and technique

Tuesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

W E ADAMS and associates Experimental esophageal surgery

COLUMBUS HOSPITAL

R M DAVISON C VOLINI M JOANNIDES, D ORTH G MUELLER and I F VOLINI Symposium on tuberculosis Thoracic surgery pneumothorax treatment including climatotherapy

COOK COUNTY HOSPITAL

JOHN B O'DONOGHUE and ROBERT LEE Treatment of empyema ward walk and presentation of cases

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL Operations with demonstration of cases

VETERANS ADMINISTRATION FACILITY

JEROME R HEAD New type of thoracoplasty chest surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL

R B BETTMAN and W A POTTS Operations

MUNICIPAL TUBERCULOSIS SANITARIUM

FRANK SWEJKA FRANK FREMMLER and GEORGE TURNER Pneumothorax pneumoperitoneum oleothorax

PRESBYTERIAN HOSPITAL

Treatment of Nontuberculous Pulmonary Suppuration

EARLE GRAY Medical aspect

GEORGE SHAMBAUGH Bronchoscopic aspect

JOHN M DORSEY Surgical aspect

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S LEVINSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H HOLINGER Bronchoscopic aspects

BENJAMIN GOLDBERG Medical aspects

WILLARD VAN HAZEL Surgical consideration, demonstration of cases and specimens surgical treatment of mediastinal tumors

T J WACHOWSKI Roentgenological considerations of mediastinal tumors

M JOANNIDES Collapse therapy of pulmonary tuberculosis

ST BERNARD'S HOSPITAL

A H MONTGOMERY and R E CUMMINGS Pericarditis with effusion demonstration of case

R J DREYER Rational treatment of empyema

S L GOVERNALE and F F FIORE Congenital cyst of lung

Wednesday Morning

EVANSTON HOSPITAL

JEROME R HEAD Indications for lobectomy

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON and GILBERT SCHNEIDER Thoracoplasty review of series of operated cases with discussion of indications technique results and demonstration of cases x ray pictures

Collapse Therapy Clinic 23 N Wacker Drive

STAFF Phenolics artificial pneumothorax pneumopneumum

Wednesday Afternoon

PRESBYTERIAN HOSPITAL

JOHN M DORSEY Operations

ST LUKE'S HOSPITAL

WILLARD VAN HAZEL Chest surgery demonstration of cases

PAUL HOLINGER Bronchoscopic aspect of chest surgery

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

W E ADAMS and associates Operations

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON GILBERT SCHNEIDER CAMILLO VOLINI and LOREN COLLINS Thoracoplasty first and second stage discussion of technique indications and results pneumolysis open intrapleural technique and post operative management

RESEARCH AND EDUCATIONAL HOSPITALS

Symposium Bronchiectasis and Pulmonary Tuberculosis

BENJAMIN GOLDBERG Medical considerations

PAUL H HOLINGER Bronchoscopic considerations

WILLARD VAN HAZEL Surgical considerations

Thursday Afternoon

COOK COUNTY HOSPITAL

R B BETTMAN and W A POTTS Operations

PASSAVANT MEMORIAL HOSPITAL

JEROME R HEAD A new type of thoracoplasty for pulmonary tuberculosis and certain unusual applications of extrapleural pneumolysis

PRESBYTERIAN HOSPITAL

JOHN M DORSEY Operations

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracic surgery

Friday Morning

ILLINOIS MASONIC HOSPITAL

MINAS JOANNIDES ROBERT H HAYES and W E KEESY Primary carcinoma of lung demonstration of cases diagnosis and treatment pulmonary abscess demonstration of cases etiology clinical picture and therapeutics

electrothorax, indications, technique and complications advantages of artificial pneumoperitoneum as an adjunct to phrenic neurectomy, operation closed intrapleural pneumolysis, two cases, indications, technique and results, phrenic neurectomy, phrenic crush, scalenotomy and electrothorax

ROBERT H HAYES Pulmonary tuberculosis, advantages of artificial pneumothorax, artificial pneumothorax, 10 cases, operation, artificial pneumothorax

MUNICIPAL TUBERCULOSIS SANITARIUM

Collapse Therapy Clinic, 23 N Wacker Drive

STAFF Pneumolysis, oleothorax, artificial pneumothorax, pneumoperitoneum

MICHAEL REESE HOSPITAL

RALPH B BETTMAN and WILLIAM TANNENBAUM Thoracoplasty operation

MAX BIESENTHAL Surgery of pulmonary tuberculosis

MAX BIESENTHAL and RALPH B BETTMAN Technique of various operations used for pulmonary tuberculosis Artificial pneumothorax, pneumolysis, thoracoplasty motion picture and diagrammatic demonstrations

RALPH B BETTMAN Treatment of empyema, injuries of the chest, presentation of cases, motion picture and diagrammatic demonstrations

WOMEN AND CHILDREN'S HOSPITAL

HALEN HAYDEN, EMELIA GRYOTAS, MARGARET AUSTIN and NORA B BRANDENBURG Bronchoscopy in relation to asthma and allied pulmonary conditions, lipiodol injection

Friday Afternoon

COOK COUNTY HOSPITAL

JOHN B O'DONOGHUE, FREDERICK TICE, RICHARD JAFFE, M J HUBENY, S H ROSENBLUM and A J HRUBY Symposium Pulmonary tuberculosis with operations

PRESBYTERIAN HOSPITAL

JOHN M DORSEY Operations

Daily

ST LUKE'S HOSPITAL

PAUL HOLINGER Exhibit

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

H C VORIS and J J KEARNS Intracranial injury—demonstration of pathology, physiology, management, surgical interference, sequelae, complications

Tuesday Morning

PASSAVANT MEMORIAL HOSPITAL

LOYAL DAVIS and JOHN MARTIN Presentation of patients emphasizing diagnosis and treatment of peripheral nerve injuries, trigeminal neuralgia spinal cord tumors and intracranial tumors

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DE TAKATS Operation Lumbar sympathectomy Symposium Neurocirculatory Diseases

R BRUNNER The use of neosynephrine in spinal anesthesia

PAUL W SMITH Mechanisms governing peripheral circulation

WILLIAM C BECK Selection of cases for sympathectomy, demonstration of sympathectomized patients evaluation of results the management of lymphedema

F K HICK Vascular accidents associated with coronary disease

H C LUETH Unusual reactions following the use of nitroglycerine

GEZA DE TAKATS The treatment of acute arterial occlusion, operability of hypertension, demonstration of cases

EVENCE KOTH Observations on and results of suction and pressure (pavac) therapy

H L MISHKIN and P J SARMA The treatment of varicose veins and ulcers

J T REYNOLDS Amputations in peripheral vascular disease

Tuesday Afternoon

MERCY HOSPITAL

C F SCHAUB and H C VORIS Neuro ophthalmology, Presentation of cases with fundi perimetric field findings, discussion of diagnostic problems presentation and dis-

cussion of cases of recurrent papilledema following cranial explorations and decompressions

PRESBYTERIAN HOSPITAL

JOHN FAVILL Diagnosis of traumatic epilepsy

A VERBRUGGHEEN Treatment of traumatic epilepsy

LOREN AVERY Diagnosis and treatment of traumatic psychoses

ST LUKE'S HOSPITAL

ERIC OLDBERG Operation

GEZA DE TAKATS Demonstration of late results in patients following sympathectomy for neurocirculatory disorders

JOHN COULTER Physical therapy in the treatment of peripheral vascular disease

GEORGE K FENN The management of the surgical diabetic

CARL A JOHNSON Neosynephrine in postoperative shock

RICHARD CAPPS The carotid sinus syndrome and its surgical significance

GEORGE SCUPHAM Classification in hypertension

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG Operations and demonstration of cases

Wednesday Afternoon

PRESBYTERIAN HOSPITAL

A VERBRUGGHEEN Operations

Thursday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG Operations and demonstration of cases

Thursday Afternoon

COOK COUNTY HOSPITAL

A VERBRUGGHEEN Demonstration Surgical paraplegia etiology, pathology, classification, physiology, treatment, prognosis

MERCY HOSPITAL

H C VORIS and H E JANDS Demonstration of choroid plexus resection in hydrocephalus cystometric studies in neurological lesions

Symposium Management of Cerebral Gliomas

V E GONDA Clinical diagnosis

J F SHEEHAN Pathologic classification and diagnosis

P A NELSON Roentgen ray treatment

H C VORIS Surgical management

C F SCHALB and H C VORIS Neuro-ophthalmology, Presentation of cases with fundi perimetric field findings discussion of diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions

PRESBYTERIAN HOSPITAL

A VERBRUGGHE Operations

MICHAEL REESE HOSPITAL

Symposium Intracranial Suppuration

ROY GRINKER Neurological aspects of intracranial suppuration

A VERBRUGGHE Surgical aspects of brain abscess

Friday Afternoon

PASSAVANT MEMORIAL HOSPITAL

LOYAL DAVIS and JOHN MARTIN Presentation of patients emphasizing the treatment of peripheral vascular diseases and malignant hypertension

PRESBYTERIAN HOSPITAL

A VERBRUGGHE Operations

ST LUKE'S HOSPITAL

ERIC OLDBERG Operation

ROENTGENOLOGY

Monday Afternoon

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Lesions of terminal ileum

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY Newer concepts in the treatment of carcinoma

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Interesting cases pathology shown by x ray

ST MARY OF NAZARETH HOSPITAL

C J CHALLENGER X ray studies of surgical conditions

Tuesday Afternoon

ST ANTHONY DE PADUA HOSPITAL

L S TICHY Sclerosis demonstration

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Gall bladder visualization following medical treatment

Wednesday Morning

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Gall bladder visualization following surgical drainage

Wednesday Afternoon

AUGUSTANA HOSPITAL

DAVID S BELLEN Diagnosis of gastro intestinal lesions.

ALBERT MERRITT BILLINGS HOSPITAL

PAUL C HODGES and associates X ray diagnosis

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Interesting bone pathology

Thursday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY Newer concepts in the treatment of carcinoma

RESEARCH AND EDUCATIONAL HOSPITALS

ADOLPH HARTUNG Conference on x ray diagnosis with particular reference to bone dystrophy lesions of the

urinary tract brain tumors and unusual lesions of the gastro intestinal tract

ST FRANCIS HOSPITAL

A C LEDOUY Use of x ray in surgical infections

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Interesting cases pathology shown by x ray

Thursday Afternoon

COOK COUNTY HOSPITAL

ROBERT F McNATTIN High voltage therapy of malignancies

M J HUBERT Roentgenological examination of appendix

MOUNT SINAI HOSPITAL

MAX COHN G DANIELLS and E LEWIN Demonstrations of interesting radiologicosurgical conditions

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A W HUNTER and W WASKOW Malignancies of lungs

Friday Morning

PASSAVANT MEMORIAL HOSPITAL

JAMES T CASE Technical considerations in gastrointestinal radiology round table discussion on radiation therapy of carcinoma of breast

EARL BARTH The evolution of primary tuberculous infection of the lungs in roentgenograms round table discussion on miscellaneous roentgen therapeutic applications

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Interesting cases pathology shown by x ray

Friday Afternoon

AUGUSTANA HOSPITAL

DAVID S BELLEN Diagnosis of lesions of urinary tract

COOK COUNTY HOSPITAL

J PAUL BENNETT Roentgenological examination of the kidneys ureters and bladder

ROBERT F McNATTIN High voltage therapy of malignancies

ST LUKE'S HOSPITAL

E L JENKINSON E W ROBERTS A F HUNTER and W WASKOW Interesting cases pathology shown by x ray

TUMORS AND IRRADIATION

Monday Afternoon

ST ELIZABETH'S HOSPITAL

J BRAMB Radium treatment of tumors

VETERANS ADMINISTRATION FACILITY

G R ALLABEN and associates Regular tumor clinic—presentation of cases, diagnosis and treatment

Tuesday Morning

MICHAEL REESE HOSPITAL

MAX CUTLER JEROME F STRAUSS and SAMUEL PEARL
MAN Radium therapy in malignant tumors of the head and neck demonstration of cases and technique

ST ELIZABETH'S HOSPITAL

M G LUKEV Sarcoma of the stomach

VETERANS ADMINISTRATION FACILITY

A E WILLIAMS Inspection of deep x ray and radium therapy unit

Tuesday Afternoon

RAVENSWOOD HOSPITAL

C A BUSWELL, J J MOORE, H P SAUNDERS and L E SCHAEFFER Cancer clinic, presentation of specimens, lantern slides, cases illustrating melanomas of shoulder and jaw

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff Symposium Bronchogenic carcinoma

S LEVINSON Pathology

ADOLPH HARTUNG Roentgenological diagnosis

PAUL H HOLINGER Bronchoscopic aspects

BENJAMIN GOLDBERG Medical aspects

WILLARD VAN HAZEL Surgical consideration, demonstration of cases and specimens, surgical treatment of mediastinal tumors

T J WALBOWSKI Roentgenological consideration of mediastinal tumors

M JOANNIDES Collapse therapy of pulmonary tuberculosis

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Symposium Tumor Surgery

A BRUNSCHWIG Experimental production of tumors and the efficacy of bacterial filtrates in the treatment of experimental sarcoma palliative treatment of pulmonary metastases from malignant tumors, late results in the treatment of benign giant-cell tumors of bone

W E ADAMS and associates Intrathoracic neoplasms
D B PHEMISTER and associates Studies in the etiology, diagnosis and treatment of bone tumors

HARVEY WILSON Extraskelatal ossifying tumors

NORMAN ROOME Air injections in the diagnosis of retroperitoneal tumors

W J NOONAN X ray treatment of spermatocele

GARFIELD PARK COMMUNITY HOSPITAL

CARROLL W STUART Malignant tumors of head and neck

LUTHERAN DEACONESS HOSPITAL

ISADORE PILOT Pathology of malignant growths in relation to therapeutic indications

VETERANS ADMINISTRATION FACILITY

MAX CUTLER and associates Annual tumor clinic Presentation of cancer cases, indications, technique and results of radium therapy

Thursday Morning

COLUMBUS HOSPITAL

D A ORTH, M HANNAN and H E DAVIS Breast cancer

LUTHERAN DEACONESS HOSPITAL

ISADORE PILOT Pathology of malignant growths in relation to therapeutic indications

MERCY HOSPITAL

W J PICKETT Unusual cases of malignancy

MICHAEL REESE HOSPITAL

MAX CUTLER and staff Results of radiation treatment of cancer of mouth, tonsil pharynx and larynx, presentation of cases Radiation treatment of cancer of the breast presentation of cases Motion pictures illustrating technique of radium treatment of cancer of mouth and cancer of cervix Transillumination of breast

ST ELIZABETH'S HOSPITAL

LEO M ZIMMERMAN Mediastinal tumors

VETERANS ADMINISTRATION FACILITY

A E WILLIAMS Inspection of deep x ray and radium therapy unit

Thursday Afternoon

PASSAVANT MEMORIAL HOSPITAL

MAX CUTLER The organization of a tumor clinic Personnel, equipment, records, follow up
Carcinoma of the Breast

JOHN A WOLFEER Surgical considerations

JAMES T CASE Pre and postoperative x ray radiation

L M ROSENTHAL Radium treatment

MAJOR GREENE Bronchogenic tumors of the neck

JOHN F DELPH and EARL BARTH Carcinoma of the larynx hypopharynx and tonsil

JOHN MOHARDT A survey of some proposed cancer cures

Friday Morning

MERCY HOSPITAL

HENRY SCHMITZ, HENRY L SCHMITZ, HERBERT E SCHMITZ and P A NELSON Symposium Radiologic therapy of malignancy

RESEARCH AND EDUCATIONAL HOSPITALS

R B MALCOLM Operations Neck dissection, carcinoma of breast, surgical pathology of breast tumors

T J WACHOWSKI X ray treatment of carcinoma of breast

GEORGE DETARNOVSKY Hemangiomas

ARRIE BAMBERGER Ewing tumor with case report

ST LUKE'S HOSPITAL

H E MOCK, WILLIAM BROWN E W RIERSON, E F HIRSCH and L J JEVANSOV Tumor clinic Demonstration of pathology, diagnosis treatment of malignancies of the breast and clavicle

WESLEY MEMORIAL HOSPITAL

I ARLE LATIMER Unusual breast tumors

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

- SYMPOSIUM Diseases of the Gastro-Intestinal Tract
 GEORGE MILLES. Pathology of carcinoma of stomach.
 T. J. WACHOWSKI. X-ray diagnosis of carcinoma of stomach.
 W. H. COLE. Total gastrectomy

- C. L. BIRCH. Anemia associated with total gastrectomy.
 M. H. STREICHER. Diagnosis of carcinoma of the rectum.
 C. B. PEESTOW. Surgical treatment of carcinoma of the rectum.

VETERANS ADMINISTRATION FACILITY

- G. R. ALLABEN and associates. Regular tumor clinic—presentation of cases, diagnosis and treatment.

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL

- DISRAELI KOBAK. General physical therapy procedures.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

- JOHN S. COULTER and S. L. OSBORNE. Clinical and experimental investigations of short wave medical diathermy

MICHAEL REESE HOSPITAL

- C. O. MOLANDER. Ward walk, physiotherapy methods.

Tuesday Morning

COOK COUNTY HOSPITAL

- DISRAELI KOBAK. In posttraumatic conditions.

Tuesday Afternoon

COOK COUNTY HOSPITAL

- I. F. HUMMON. Physical therapy in infantile paralysis.

MICHAEL REESE HOSPITAL

- S. PERLOW and C. O. MOLANDER. Physical therapy in the treatment of circulatory disturbances.

Wednesday Morning

COOK COUNTY HOSPITAL

- DISRAELI KOBAK. In postoperative traumatic infections.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

- HERMAN CHOR. Rationale in muscle disorders.

- JOHN S. COULTER. Clinical and experimental results.

MICHAEL REESE HOSPITAL

- FRANK GLASSMAN and C. O. MOLANDER. Physical therapy in the treatment of fractures.

Wednesday Afternoon

COOK COUNTY HOSPITAL

- I. F. HUMMON. Physical therapy in neurosurgical and neurological conditions.

PASSAUNT MEMORIAL HOSPITAL

- J. S. COULTER. Physical therapy in fractures.
 SUMNER L. KOCH, MICHAEL L. MASON and J. S. COULTER. Physical therapy in hand injuries.

MICHAEL REESE HOSPITAL

- I. WOLIN and C. O. MOLANDER. Physical therapy in the treatment of poliomyelitis.

- SIDNEY SIDEMAN and C. O. MOLANDER. Physical therapy in treatment of spasms.

Thursday Morning

COOK COUNTY HOSPITAL

- DISRAELI KOBAK. Physical therapy in low back conditions.

GARFIELD PARK COMMUNITY HOSPITAL

- MILTON SCHMITT. Hyperpyrexia in gonorrheal arthritis. Value of heating tissues by induction—hyperpyrexia.

ILLINOIS CENTRAL HOSPITAL

- JOHN S. COULTER. Under water exercises in the treatment of fractures of weight bearing bones.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

- J. S. COULTER and S. L. OSBORNE. Hyperpyrexia in chronic infectious arthritis.

- F. CHANDLER, J. R. NORCROSS and J. S. COULTER. Management of low back conditions.

MICHAEL REESE HOSPITAL

- BERT FINN. Hyperpyrexia in gonorrheal arthritis.

Thursday Afternoon

COOK COUNTY HOSPITAL

- I. F. HUMMON. Manipulative treatment in low back conditions.

GARFIELD PARK COMMUNITY HOSPITAL

- MILTON SCHMITT. Hyperpyrexia in gonorrheal arthritis. Value of heating tissues by induction—hyperpyrexia.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

- EMIL HATSER and J. S. COULTER. The rôle of physical therapy in common disorders of the foot.

MICHAEL REESE HOSPITAL

- JULIUS GREINER and C. O. MOLANDER. Physical therapy in treatment of peripheral nerve injuries.

Friday Morning

COOK COUNTY HOSPITAL

- DISRAELI KOBAK. Physical therapy in bursitis.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

- J. S. COULTER. Physical therapy in traumatic arthritis.

Friday Afternoon

COOK COUNTY HOSPITAL

- I. F. HUMMON. In the prevention of deformities.

MICHAEL REESE HOSPITAL

- LESTER FRANKENTHAL and C. O. MOLANDER. Physical therapy in treatment of chronic pelvic inflammation.

ST. LUKE'S HOSPITAL

- JOHN S. COULTER. In reconstruction surgery.

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

CASPER M. EPSTEIN Plastic, faciomaxillary surgery

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER and A. W. PENNALE Demonstration of cases of corrected temporomandibular ankyloses harelips and cleft palate cases pedicle flap and full thickness graft cases repair of burns, traumatic injuries also plastic repairs of controlled carcinoma cases

ST. JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN Oral surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL

I. I. MUSKAT and H. M. GOLDEN Plastic surgery of the nose and face

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD Elastic traction in plastic surgery and fractures of the jaw

MICHAEL KLESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery, treatment of injuries to the face

Wednesday Morning

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLIMSTED Operations

RESEARCH AND EDUCATIONAL HOSPITALS

PAUL GREELEY Plastic surgery

ST. LUKE'S HOSPITAL

H. A. POTTS and F. W. MERRIFIELD Clinic

Wednesday Afternoon

MOUNT SINAI HOSPITAL

E. ALSON and associates Oral surgery

Thursday Morning

COOK COUNTY HOSPITAL

JOSEPH F. SCHAEFER and A. W. PENNALE Cases of carcinoma of mouth, lips and face—with colored photographs of lesions before and after radiation

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLIMSTED Operations

MICHAEL KLESE HOSPITAL

CASPER EPSTEIN Oral surgery

ST. JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN Oral surgery

Friday Morning

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLIMSTED Operations

RESEARCH AND EDUCATIONAL HOSPITALS

L. W. SCHULTZ Oral surgery cleft palates and harelips

ST. LUKE'S HOSPITAL

H. A. POTTS and F. W. MERRIFIELD Clinic

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL

L. W. SCHULTZ A treatment for subluxation of the temporomandibular joint

EXPERIMENTAL SURGERY

Thursday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

W. P. KLEITSCH The effect of intravenous glucose and saline solutions on the motility of isolated segments of small intestine

L. W. SCHULTZ The effect of sclerosing agents on joint membrane, and the clinical applicator to dislocations or subluxations

S. R. ROSEYTHAL The toxic and antitoxic of burns

C. B. PRIESTON The use of vitamin oils in the treatment of burns produced experimentally

LLOYD ARNOLD Studies in the development of a new mask for use in the operating room

W. H. COLE Experimental studies on the mechanism of production of so-called collapse

F. D. HERROLD Experimental and clinical experiences with urinary antiseptics

D. P. SLAUGHTER Studies on the excretory function of the liver

G. L. ZECHEL Experiments with tissue cultures with particular reference to malignant tumors

G. DETAKATS, W. BECK and C. SWITZER The experimental production of pulmonary emboli

Friday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

LEON ARYES Acceleration of bone growth and repair as determined by deposition of dye in the callus

R. A. BOSSABARGER, S. FREEMAN and A. C. IVY The rôle of the stomach in calcification of bone (Exhibit of gas trepanned puppies showing homogenous osteoporosis)

ELMER J. LOCUR The effect of various foods upon bile secretion with and without return of bile to the gastrointestinal tract

C. R. SCHMIDT and J. M. BEAZELL The effect of diet on pancreatic secretion (The results obtained guide the postoperative care of a patient with duodenal fistula)

WILLIAM BACHRACH and SAMUEL J. FOGELSON Common duct transplantation (Results show site of implantation of common duct is important in preventing subsequent ascending infections of biliary passages)

MICHAEL L. MASOV and HAZEL B. ALLEN Experimental studies on tendon repair

LEO M. ZINGERMAN Surgical repair of inguinal hernia as guided by anatomical studies (A simplification of surgical technique)

JOHN MARTIN Negative effects of midbrain lesions on gastric secretion motility and gastro intestinal ulceration in monkeys and cats A Horsley Clarke apparatus was used to produce midbrain lesions in cats and monkeys
H CHOR The rationale of physical therapy in muscle disorders Experimental observations on massage passive

movement electrical stimulation and rest on muscle atrophy and regeneration in the lower motor neuron type of paralysis

MICHAEL REESE HOSPITAL
RALPH B BETTMAN Closure of large bronchi.

OPHTHALMOLOGY

Monday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL
A C KRAUSE Discussion of hereditary retinoses
CHILDREN'S MEMORIAL HOSPITAL
G GUTBOR Orthoptics
COOK COUNTY HOSPITAL
E B FOWLER Fundus diagnostic clinic
ILLINOIS EYE AND EAR INFIRMARY
R VON DER HEYDT and J LOWELL Operations
DWIGHT C ORCUTT and I O CONNOR Diagnostic clinic
MERCY HOSPITAL
C F SCHAUB F I BARNETT and E A ROLING Fundus
MICHAEL REESE HOSPITAL
PHILIP HALPER Orthoptics

Tuesday Morning

GRANT HOSPITAL
O H KRAFT and B T HOFFMAN Operations cases
NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
GEORGE GUTBOR Orthoptics classification of squint
SANFORD R GIFFORD Concomitant and paralytic squint
RUSH MEDICAL COLLEGE
DR WILBER Histopathology

Tuesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL
C V DEVNEY Orthoptics
COLUMBUS HOSPITAL
M GOLDENBURG Eye clinic
COOK COUNTY HOSPITAL
C F YERGER Medical ophthalmology
ILLINOIS EYE AND EAR INFIRMARY
THOMAS D ALLEN Operation for glaucoma and cataract
LOUIS HOFFMAN and E K FINDLAY Diagnostic clinics
MERCY HOSPITAL
C F SCHAUB and H C VORIS Neuro ophthalmology
Presentation of cases with fundi perimetric field findings discussion of diagnostic problems presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions
MOUNT SINAI HOSPITAL
J LEBENSOHN and F SELINGER Operations
MICHAEL REESE HOSPITAL
T M SHAPIRA Fundus clinic
ST LUKE'S HOSPITAL
E A VORISKA Presentation of clinical cases

Wednesday Morning

COOK COUNTY HOSPITAL
SANFORD R GIFFORD and N LAZAR Retinal detachment
GRANT HOSPITAL
O H KRAFT and B T HOFFMAN Operations and cases
RUSH MEDICAL COLLEGE
W F MONCREIFF Cataract motion pictures

Wednesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL
S S BLANSTEIN End results of retinal detachment
CHILDREN'S MEMORIAL HOSPITAL
R C GAMBLE and E A VORISEK Diagnostic clinic
ILLINOIS EYE AND EAR INFIRMARY
DWIGHT C ORCUTT Operation for glaucoma and cataract
S J MEYER and T ZICKMAN Retinal detachment
K H CHAPMAN Orthoptics
MERCY HOSPITAL
C F SCHAUB, F I BARNETT and E A ROLING Fundus
MICHAEL REESE HOSPITAL
S J MEYER and D SYDACKER Retinal detachment
ST BERNARD'S HOSPITAL
C P SULLIVAN Ocular fundi lantern slide demonstration
ST LUKE'S HOSPITAL
J WALSH Clinical cases
U S MARINE HOSPITAL
ALFRED N MURRAY Eye injuries

Thursday Morning

CRANT HOSPITAL
O H KRAFT and B T HOFFMAN Operations and cases
SOUTH SHORE HOSPITAL
JOHN STANTON Removal of foreign bodies

Thursday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL
L BOTHMAN Demonstration and discussion of disciform macular degeneration (Kuhnt Junius)
COOK COUNTY HOSPITAL
F B FOWLER Fundus clinic
ILLINOIS EYE AND EAR INFIRMARY
E K FINDLAY Operations
LOUIS HOFFMAN Operations
THOMAS D ALLEN Glaucoma
ILLINOIS MASONIC HOSPITAL
ALVA SOWERS Cataract extraction Fischling technique
dinitrophenol cataracts—treatment results

MERCY HOSPITAL

C F SCHAU and H C VORIS Neuro ophthalmology.
Presentation of cases with fundi, perimetric field findings, diagnostic problems, recurrent papilledema following cranial explorations and decompressions

MICHAEL REESE HOSPITAL

JACK COWAN Glaucoma clinic

RUSH MEDICAL COLLEGE

DR JACOBSON Fundus clinic

ST LUKE'S HOSPITAL

FRANK E BRAWLEY and J W CLARK Clinical cases

Friday Morning

GRANT HOSPITAL

O H KRAFT and B T HOFFMAN Operations and cases

Friday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

M SHELLMAN Cataract results

CHILDREN'S MEMORIAL HOSPITAL

R O RISER Diagnostic clinic

COLUMBUS HOSPITAL

M GOLDENBURG and C J SCHERIBEL Eye clinic

HENROTIN HOSPITAL

GEORGE W MAHONEY, E A ROLING and I BARNETT Clinic

ILLINOIS EYE AND EAR INFIRMARY

S J MEYER and T ZICKMAN Glaucoma and cataract

R VON DER HEYDT Slit lamp demonstration

RUSH MEDICAL COLLEGE

E SELINGER Medical ophthalmology

ST LUKE'S HOSPITAL

R C GAMBLE Clinical cases

OTOLOGY

Monday Afternoon

COOK COUNTY HOSPITAL

NORMAN LESHIN Interesting cases with methods of examination and diagnosis and endoscopy

SAMUEL PEARLMAN Carcinoma of the larynx, bronchocopy, esophagoscopy

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER Facial plastic surgery

SIDNEY POLLACK Nasal fractures

BERNARD M COHEN Nasal and ear prostheses

Symposium Intracranial Otogenic Complications

M GLATT Petrositis

JACOB LIFSCHUTZ Brain abscess

C H CHRISTOPH Lateral sinus thrombosis

RESEARCH AND EDUCATIONAL HOSPITALS

O C VAN ALYEA Surgical anatomy of nasal sinuses

MANUEL G SPIESMAN Diseases of the pharynx

SILVIO A SCIARETTA Conservative treatment of chronic suppurative otitis media

RUSH MEDICAL COLLEGE

LOUIS T CURRY and FRANK WOJNIAK Sulfanilamide in the treatment of meningitis

Tuesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

J R LINDSAY Petrositis

GRANT HOSPITAL

GEORGE DENNIS FRANCIS L LEDERER, S H SOBOROFF and GEORGE F MCINTYRE Operations and cases

MOUNT SINAI HOSPITAL

JOSEPH C BECK, ALFRED LEVY, JACOB LIFSCHUTZ, S M MORWITZ, FRANCIS L LEDERER, M R GUTTMAN, M GLATT, J FISHLAN, M KRAMER and A HOLLENDER Clinics with special reference to plastic surgery and treatments about the head and neck.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J F DELPH, A H ANDREWS and GLENN J GREENWOOD Technique of endobronchial aspiration

T P O'CONNOR Nasopharyngitis

MARION A ANDREWS Results of different methods for raising the temperature of the antrum

GLENN J GREENWOOD Audiometric readings in allergy

H C BALLENGER Audiometric testing

J F DELPH Benign tumors of the vocal cords

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME C STRAUSS and SAMUEL PEARLMAN Radium in malignancies of head and neck

RESEARCH AND EDUCATIONAL HOSPITALS

PAUL H HOLINGER Diseases of the larynx

ST JOSEPH'S HOSPITAL

AUSTIN A HAYDEN Conservation of hearing, mastoid and sinus surgery

Tuesday Afternoon

COOK COUNTY HOSPITAL

A LEWY The mastoid and the labyrinth

J LIFSCHUTZ Pneumography

HENROTIN HOSPITAL

J C BECK and M R GUTTMAN Tumors about the head and neck, plastic and reconstructive surgery of nose

O E VAN ALYEA Irrigation of frontal and maxillary sinuses, supplemented by colored motion pictures and anatomic specimens

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN Nasal and facial plastic surgery treatment of injuries to the face

RESEARCH AND EDUCATIONAL HOSPITALS

FRANCIS LEDERER Ear, nose and throat plastic surgery

FRANCIS LEDERER, J J THEOBALD, W H THEOBALD

NOAH FOX, S SHAPIRO, A R HOLLENDER, O E VAN ALYEA, J HARNED, S HORWITZ, N FABRICANT and

L FISHLAN Operations

RUSH MEDICAL COLLEGE

ELMER HAGENS Pathology of the petrous bone in cases dying of meningitis

PAUL CAMPBELL Function of vestibular apparatus and a few details of tonsillectomy (colored motion pictures)

ST MARY OF NAZARETH HOSPITAL

J J KILLEEN Mastoiditis in children

Wednesday Morning

COOK COUNTY HOSPITAL

- I MUSKAT Plastic surgery of nose and face
L. CERRY Mastoiditis and meningitis

GRANT HOSPITAL

- GEORGE DENNIS FRANCIS L. LEDERER S. H. SOBOROFF
and GEORGE F. MCINTYRE Operations and demonstration of cases

MOUNT SINAI HOSPITAL

- JOSEPH C. BECK ALFRED LEWY JACOB LIFSCHUTZ S. M.
MORWITZ FRANCIS LEDERER M. R. GUTTMAN M.
GLATT J. FISHMAN M. KRAMER and A. HOLLENDER
Clinics with special reference to plastic surgery and
treatments about the head and neck

NORWEGIAN AMERICAN HOSPITAL

- J. W. HARNED Operations clinical conference the treatment of asthma in otolaryngological practice

MICHAEL REESE HOSPITAL

- JOSEPH BECK and M. REESE GUTTMAN Surgical treatment of otogenic meningitis and operations

ST. ELIZABETH'S HOSPITAL

- F. A. DULAK Ozena

Wednesday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

- A. LEWY E. BLONDER D. DOSEFF J. PROHOWNIA and
FRANK J. PISZKIEWICZ Presentation of clinical cases
and talks on interesting subjects

- J. CAVANAUGH G. WOODRUFF M. HOELTGEN and B.
REZNICK Interesting cases talk on nasal sinuses
discussion of anatomy of temporal bone lantern slides

RESEARCH AND EDUCATIONAL HOSPITALS

- J. THEOBALD Complications of middle ear infections
SHERMAN L. SHAPIRO Neuro otology

RUSH MEDICAL COLLEGE

- THOMAS W. LEWIS and RICHARD WATKINS Causative
factors and results of treatment of vasomotor rhinitis
with foreign protein

ST. ANNE'S HOSPITAL

- JERRY HAYDEN Traumatic fistula of Stenson's duct carcinoma of aryepiglottic fold laryngeal papilloma

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

- J. R. LINDSAY Septic otitis and lateral sinus thrombosis

GRANT HOSPITAL

- GEORGE DENNIS FRANCIS L. LEDERER S. H. SOBOROFF
and GEORGE F. MCINTYRE Operations and demonstration of cases

MERCY HOSPITAL

Symposium Nasal Accessory Sinuses

- HERBERT NASH and R. KERWIN Anatomy and physiology
of nose and accessory sinuses

- G. J. MUSGRAVE Demonstration of Proetz method of
visualization showing pictures Ferns Smith operation
C. H. CHRISTOPHER Maxillary sinuses intranasal radical
C. T. JORDAN Caldwell Luc operation

MOUNT SINAI HOSPITAL

- JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M.
MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN, M.
GLATT, J. FISHMAN, M. KRAMER and A. HOLLENDER

Clinics with special reference to plastic surgery and
treatments about the head and neck

NORTHWESTERN UNIVERSITY MEDICAL
SCHOOL

- L. B. AREY, B. J. ANSON, J. GORDON WILSON and associates Reconstruction of tonsils stapes petrous bone

- J. G. WILSON and B. J. ANSON Reconstruction of bone
pathology in cases of deafness Motion pictures of
vestibular reaction

- J. F. DELPH Simplified caloric tests

- J. GORDON WILSON Spontaneous nystagmus in lesions
of the brain

- E. L. ROSS Toxic reactions in animals

RESEARCH AND EDUCATIONAL HOSPITALS

- NATHAN H. FOX and JOHN W. HARNED, JR. Rhinologic
surgery allergy in relation to otolaryngology

ST. JOSEPH'S HOSPITAL

- AUSTIN A. HAYDEN Conservation of hearing mastoid and
sinus surgery

SOUTH SHORE HOSPITAL

- JOHN STANTON Management of acute mastoiditis

Thursday Afternoon

COOK COUNTY HOSPITAL

- NORMAN LESHIN Interesting cases with methods of
examination and diagnosis and endoscopy

- SAMUEL PEARLMAN Carcinoma of the larynx bronchoscopy

RESEARCH AND EDUCATIONAL HOSPITALS

- FRANCIS LEDERER and N. T. PATTERNGALE Cancer of the
ear nose and throat

RUSH MEDICAL COLLEGE

- GEORGE E. SHAMBAUGH, JR. and LINTON WALLNER The
treatment of deafness

Friday Morning

CHILDREN'S MEMORIAL HOSPITAL

- GEORGE LIVINGSTON Complications of ear infections

- PAUL HOLINGER Bronchoscopy in children

COOK COUNTY HOSPITAL

- T. C. GALLOWAY and H. E. DAVIS Selective treatment in
malignancy about the head

- J. LIFSCHUTZ Pneumography

GRANT HOSPITAL

- GEORGE DENNIS FRANCIS L. LEDERER S. H. SOBOROFF
and GEORGE F. MCINTYRE Operations and demonstration of cases

MOUNT SINAI HOSPITAL

- JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M.
MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN, M.
GLATT, J. FISHMAN, M. KRAMER and A. HOLLENDER
Clinics with special reference to plastic surgery and
treatments about the head and neck

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

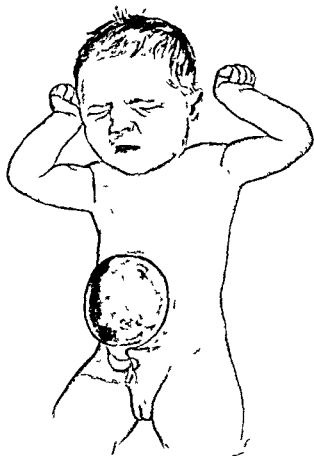
- A. R. HOLLENDER Physical therapeutic methods

- W. THEOBALD Nasal accessory sinus disease

- PAUL H. HOLINGER Bronchoscopy and esophagoscopy

RUSH MEDICAL COLLEGE

- DANIEL B. HAYDEN and E. L. CHAINSKI Conditions producing
tinnitus evaluation of methods of treatment



Drawing made in color from subject. Note bluish mass covered by shiny translucent membrane. At the lower pole of the mass the ligated stump of the umbilical cord is shown.

Congenital Umbilical Hernia —Julius Jarcho



Drawing made in colors from subject. Note bluish mass covered by shiny translucent membrane. At the lower pole of the mass the ligated stump of the umbilical cord is shown.

Congenital Umbilical Hernia —Julius Jarcho

or even to 10,000 deliveries, several thousand of such cases must have occurred in Europe in the last 50 years. A review of the literature, however, shows that only a few more than 100 cases have been reported. It is probable, he concludes, that most of the children with congenital umbilical hernia are stillborn or die soon after birth and the cases are never reported. It is probably true also that many such infants are delivered by midwives and are never seen by a physician, much less by a surgeon. If this is the case in modern times, it was no doubt still more true in the earlier centuries. This explains why umbilical hernia was not recognized as congenital by the earlier writers.

In 5,017 successive deliveries at the Sydenham Hospital, New York City, resulting in 5,079 births, of which 4,910 were living children and 169 were stillborn, only 2 cases of congenital umbilical hernia are recorded. The first is the case I am reporting, the second, while of sufficient size to draw attention, was not so formidable as to require an immediate operation.

In an obstetric practice of 30 years, in the early days of which the author delivered the patients in their own homes and took personal care of the newborn, small umbilical hernias after separation of the cord were not very uncommon, and were invariably cured by strapping with adhesive plaster.

Thus one may fairly assume that, if the cases had been followed up, small herniations at the umbilicus would be found to have occurred much more frequently than the hospital records would indicate. One thing, however, is certain—that of massive hernia only this 1 case has been observed at the Sydenham Hospital, the only other herniation of sufficient size to be noted on the chart not having been extensive enough to demand prompt surgical interference.

REPORT OF CASE

I. C., white, aged 17 years, *secundipara*, was admitted to the Sydenham Hospital May 3, 1932, in active labor. She gave a history of one previous pregnancy which went to term, when, at the age of 16 years, she was delivered of a normal female child, who is living and well.



Fig. 1 left Frontal view showing defect in abdominal wall at umbilical area. Hernia of the liver. At the lower pole of the hernial mass may be seen the tied stump of the cord. Taken 4 hours after birth.

Fig. 2 Same as Figure 1. Lateral view.

The patient was delivered spontaneously at term of a living female child, weighing 6 pounds 14 ounces.

Case report of Baby C. The child was born spontaneously at term. A large defect was found in the abdominal wall, through which a dark red, bluish mass protruded (frontispiece). This was covered by a thin, shiny, translucent membrane, at the lower pole of which the cord emerged. This membrane, or hernial sac, continued with the covering of the umbilical cord. The child was otherwise normal (Figs. 1 and 2).

Diagnosis massive hernia into the umbilical cord. The dark bluish content of the hernia was assumed to be the liver. This assumption was corroborated 12 hours later by operation.

A vertical incision was made through the translucent membrane, i.e., the hernial sac. The entire sac covering the liver was removed down to the edges of the abdominal defect. The skin at the edges of the defect was incised and dissected until the fascia was reached. The liver was adherent to the surrounding tissues, and was separated by sharp and blunt dissection. Considerable bleeding occurred from the liver tissue. Several sutures were put in the liver for hemostasis and the organ was gently replaced into the abdominal cavity. A number of silk tension sutures were taken through the skin, fascia, muscle, and peritoneum. Traction was exerted on the tension sutures to facilitate the replacement of the liver into the abdominal cavity.



Fig 3. left One month after operation. Showing healthy child. Note irregular abdominal scar.

Fig 4. Shows well developed healthy child at the age of 16 months. Note strong abdominal wall.

and to approximate the edges of the peritoneum which was then closed by continuous plain catgut suture. The fascia was approximated with interrupted chromic gut sutures. The tension sutures were tied and interrupted silk sutures placed in the skin between them. In the first days following operation normal saline solution with 5 per cent glucose was given intravenously and by hypodermoclysis to provide fluids after which the child was fed on breast milk and made a satisfactory gain in weight. She was discharged in good condition at the age of 1 month (Figs 3 and 4).

This child was observed up to the age of 3 years and 1 month. On last examination (Fig 5) she was found to be a healthy sturdy child. The operative scar was strong and there was no sign of recurrence of the hernia. The mother has since had a third pregnancy with normal labor giving birth to a healthy male child.

The cause of congenital umbilical hernia is now generally considered to be the failure of the primitive intestinal loop to withdraw into the abdominal cavity toward the end of the third month of embryonic life. Normally between the second and third month of embryonic development, this primitive loop develops within the umbilical sac and outside the abdominal cavity. By the end of the third month, the intestines normally are drawn into the abdominal cavity. However, if this fails to occur, the child is born with what Sir Arthur Keith calls "an uncured hernia at the navel," which may result in so large a defect in the abdominal wall that a



Fig 5. Shows well developed healthy and intelligent child of 3 years and 1 month.

large portion of abdominal viscera becomes herniated before birth.

Discussing Niebuhr's case, C. P. Bardeen notes that the embryonic gastroduodenal loop from which the liver and pancreas develop is never normally contained within the umbilical sac, so that if the liver is included in the sac when the child is born it must have been drawn down in a later period of fetal life, probably due to "a slow stretching of the ligaments of the liver."

What factors are responsible for the failure of the intestines or liver, in these cases, to withdraw normally from the cord into the abdominal cavity is not known with certainty. Bergglas has discussed various hypotheses in this connection. Until rather recently the view has received general acceptance that this failure is due to the pathologic persistence of the vitelline duct, but against this concept it is now urged that this duct has already dwindled down to a thin thread in the fifth week of embryonal life when the embryo is only 5 to 7 millimeters long, whereas the development of the physiologic umbilical opening is not observed until the embryo is 30 to

40 millimeters long. Hence it cannot properly be related to the vitelline duct, nor would persistence of the latter explain the prolapse of large intestinal loops, liver, spleen, pancreas, etc. On the other hand, attempts have been made to relate it to defects of the abdominal wall, it has been claimed that the part of the hernial sac where the liver lies corresponds not to the dilated umbilical cord but to the supra-umbilical portion of the abdominal wall, which in these cases is faulty in its development.

Bergglas, while attaching importance to this view, thinks that an inhibition of the growth of the abdominal wall could not alone account for the presence of abdominal organs in the sac. He draws attention to a second factor of very great importance, namely, a marked disturbance in the relationship of the growth process of the abdominal *cavity* and that of the abdominal *contents*. Through lack of correlation, the cavity is too small and the visceral content too large. This disturbance of correlation would occur between the third and the tenth week, which represents the termination of the teratogenous period. The rather long time between these two periods would account for the existence of two types of congenital umbilical hernia that are observed, namely, one with an avascular membrane, which also covers the divergently coursing umbilical vessels, and another type in which the sac is composed of peritoneum. The first type is the commoner, and it is in these cases, which constitute the great majority, that immediate operation is of the greatest importance, for if no operation is carried out, the avascular membrane will become necrotic and the child will die. Other possible contributory factors hindering the abdominal organs from entering the abdominal cavity are hyperlordosis of the spinal column, and anomalies of the mesentery.

The presence of other associated anomalies or malformations is not infrequent in these cases. Aribat found these expressly mentioned in 20 of the 160 cases he collected, in all these cases the children were stillborn or died shortly after birth. In 1930 Gruber described 5 anatomical specimens showing congenital umbilical hernia associated with other mal-

formations. Kleiner (1930) reports 2 cases of this kind, Smith (1932) 4, and Krumm (1931), Caffier (1933), and Ginglinger (1935) 1 case each.

In cases of this type an etiological factor has been sought in heredity, and there has been a widespread belief that congenital hernia in general is inherited and may run in families. In the case I am here reporting neither parent showed any signs or gave any history of congenital hernia, and, as has been noted, 2 other children in the same family were entirely normal, only the second of the 3 children exhibiting this malformation. One may, perhaps, emphasize the fact that all three pregnancies, labor, and puerperium were entirely normal with the exception of the congenital anomaly presented in the child of the second pregnancy.

A review of recent cases shows that the histories do not indicate any hereditary tendency to hernia of any kind in the families in question. Moreover, in most cases the pregnancy and labor are entirely normal, without any illness or trauma to explain this fetal maldevelopment.

As a rule, except in cases of very small congenital umbilical hernia, diagnosis presents no difficulty, the condition being self-evident as soon as the child is delivered. The hernial sac, which may consist of peritoneum, thin layer of Wharton's jelly and amnion, is often translucent, as in the case here reported, so that the contained viscera may readily be seen through it. The small intestines are usually present in the sac, portions of the large intestines are often included, and in some cases, as here, the liver too, or a considerable portion of it.

Among the 109 cases of congenital umbilical hernia tabulated by Altpeter, the liver was in the sac in 31 instances. This was true also in 14 of the 46 more recent cases reported since 1929.

A few instances have been recorded in which the sac had ruptured and the intestines lay free on the abdominal wall. Massabuau and Guibal reported such a case, and collected 22 similar cases from the literature. In some of these the sac was completely absent, in others only vestiges remained, while in still others

there was merely a tear in the sac. Their collection does not include any of the three early ones of this type reported by Hey, nor the recent case of Krumm (1931). In the latter there was no hernial sac, and the liver as well as the intestines lay free on the abdominal wall. Other congenital deformities were present and the child died in 18 hours without operation.

The presence of an umbilical hernia, even though it be a large one, does not often affect the course of labor. Stocckel notes that this is because the parts are soft. If however the umbilical cord is short it will interfere with labor. In most of the instances reported it is expressly noted that labor was normal and delivery spontaneous as in my own case. But that the umbilical hernia may occasionally cause some obstruction to labor is shown by a recent report from McCaughan, who writes:

"The delivery proceeded normally until the level of the umbilicus was reached and there it was definitely retarded. The baby was breathing so no effort was made to finish the delivery for several minutes. When pressure on the abdomen and slight traction failed to deliver the buttocks, a hand was slipped along the baby's abdomen, in the belief that there was probably a short cord preventing normal delivery, and the hernia was encountered. The newborn was flexed to right angles at the hip with head and shoulders across the mother's symphysis, and delivery easily accomplished."

While it is probable that in olden times infants born with a large umbilical hernia died soon after birth, as the statements of Pare and Hamilton would suggest, some of those with small hernias undoubtedly survived, carrying their hernias into childhood or even into adult life. Unquestionably many of the infantile umbilical hernias mentioned by the earlier writers were actually of congenital origin.

One of the early methods of treatment appears to have been the application of a protective bandage without any attempt to reduce the hernia. Aribat lists some cases of this type, and in all probability this method was employed by many a midwife when the hernia was relatively small. Later on, various conservative methods were employed, in

which the hernia was reduced and the reduction maintained by use of adhesive plaster or a compression bandage or by some method of disposal of the sac and closure of the abdominal wall.

In modern days, however, radical operation is almost universally considered the safest procedure in cases of large or massive hernia. Its essential features, as stated by I. Raser, are "incision of the sac, separation and reduction of the contents, and closure of the abdominal wall," the exact technique depending upon the conditions found in the individual case and the judgment of the operator.

Cullen states that in all cases of congenital umbilical hernia except the very smallest, radical operation should be done at once. He points out that even if the intestines can be easily replaced by taxis within the abdominal cavity, the thin walled sac still persists, and as its walls are only amnion and peritoneum, they are likely to tear, and there will be danger of peritonitis.

Pybus points out the danger of strangulation of such a sac if it is not removed immediately by radical operation. There is also the possibility of its contents being injured when the cord is tied. Wherever the condition is amenable to operation he favors radical removal of the sac and cord, followed by closing of the enlarged umbilical ring. He has seen this type of malformation associated with ectopia of the bladder or imperforate rectum.

Notwithstanding a certain percentage of fatalities after radical operation, in the great majority of cases the child's best or only hope lies in this procedure.

Cumston points out that if these hernias are not operated on immediately after birth, there is danger of desiccation occurring, and becoming the starting point of infection and inflammatory attacks in the abdominal viscera. If operation is carefully performed at once, it is his opinion that babies will stand the operative shock very well. According to von Reuss and Parmelee, even where the sac has ruptured, an immediate operation may result favorably.

That radical operation is growing in favor and is giving an increasing percentage of cures

is evident from a comparison of recent statistics with those of an earlier date

In only 68 of the 160 cases (40 per cent) cited by Arbat in 1901 had the radical operation been done, resulting in 47 recoveries, while of the 109 cases tabulated by Altpeter since 1900, 91 (90 per cent) had been operated on by a radical method with 69 recoveries. Of the 46 cases reported since 1929, all but 11 were submitted to radical operation. Four of these 11 cases were stillborn, 1 died immediately after birth, and 1, 18 hours after birth (with other congenital malformations), 4 were treated by a conservative operation, and 1 by Ahlfeld's alcohol method. This last child recovered and was in good health at the age of 7 months when it was accidentally killed. Of the 4 children treated by conservative operation, 3 recovered, 1 being reported as well at the age of 8 months.

Among the 35 cases in which radical operation was done there were only 5 deaths. Of those recovering after operation, 5 have been followed up for more than a year. The longest follow-up reported is that of Vogel, whose patient is entirely normal with the scar well healed at the age of 9 years. Ludwig reports 2 cases followed up $2\frac{1}{2}$ and $5\frac{1}{2}$ years, respectively. Gordon reports a child living and well 3 years after operation and Freshman a case well at $3\frac{1}{2}$ years. Of the 45 cases in which the liver or a portion of it was stated to be herniated, 11 recovered, this includes the case of Ludwig followed up for $2\frac{1}{2}$ years. In Niebuhr's case with both liver and gall bladder in the hernia, the child was well 3 months after radical operation.

Undoubtedly best results are obtained by radical operation within a few hours after birth. Newborn infants tolerate operation and anesthesia remarkably well. Friedrich, emphasizing this point, states that in his cases, the infant showed normal gain in weight after operation. In one of these the infant was premature and had an extensive hernia, yet rallied well from the operation and progressed as satisfactorily as any premature infant. At 4 months of age it was entirely normal, but died later of pneumonia.

If, however, the child is born outside the hospital and in some isolated community

where it cannot be sent to the hospital immediately, a conservative method of treatment may be the only one possible, and instances are on record in which the results have been surprisingly good.

In 1899, Ahlfeld described a method by which the hernia was reduced as far as possible under light narcosis, after careful cleansing of the hernial sac and surrounding skin, and then alcohol compresses applied and covered by a bandage. In the first case he treated the liver was present in the hernial sac and complete reduction was impossible, yet the child thrived without operation, and a year later the scar was excised and the wound closed. This patient was known to be living and well at the age of 15 years. Few surgeons, however, would allow a case of this kind to go without operative intervention today. With a small hernia palliative measures may result in cure, but when the hernia is massive, radical operation is imperative and must be done without delay. As Dott graphically puts it "The child should pass straight from the womb onto the operating table."

SUMMARY AND CONCLUSIONS

- 1 Massive congenital umbilical hernia is a rare surgical condition requiring immediate radical operation in the first hours following birth.

- 2 The literature on congenital umbilical hernia is reviewed.

- 3 A case is described in which a massive congenital hernia of the liver into the umbilical cord was successfully treated by radical operation 12 hours following the birth of the child.

- 4 Operative intervention and anesthesia were remarkably well borne by this infant.

- 5 The technique of operation employed in this case is described.

- 6 No grounds are found for a belief that congenital umbilical hernia is an inherited affection, or one that runs in families.

- 7 The case herein reported would refute the assumption that congenital umbilical hernia is an inherited affection, and the survey of the literature would indicate to my mind that there is no ground for such popular concept.

BIBLIOGRAPHY

1. AHLFELD, F. Der Alkohol bei der Behandlung inoperable Bauchbrüche. Monatschr f Geburtsh u Gynaek 1899 10 124
2. Idem Heilung von Nabelschnurbrüchen auf konservativen Weg. Zentralbl f Gynaek 1914 88 1053
3. ALTFETER E. Ueber Nabelschnurbrüche. Kiel University Thesis 1931
4. ARBAT P. Contribution à l'étude des hernies ombilicales congénitales. Thèse de doct. Paris 1900-01
5. BARD S. A Compendium of the Theory and Practice of Midwifery 5th ed p 1807 New York Collins & Perkins 1819
6. BARDEEN C P. Personal communication loc cit 30
7. BERGLAS B. Zur Genese und Therapie der Nabelschnurbrüche. Arch f Gynaek 1933 152 214
8. CAFFIER P. Ueber angeborene Bauchspalten und kombinierte Entwicklungsstörungen. Zentralbl f Gynaek 1933 57 1103
9. CELSUS AURELIUS C. Of Medicine in Eight Books. Translated by James Greive. London Wilson & Durham Book VII Chap V 1756
10. COOPER (Sir) A P. The Anatomy and Surgical Treatment of Crural and Umbilical Hernia. London Longmans 1807
11. CULLEN T S. Embryology. Anatomy and Diseases of the Umbilicus. Chap 27 p 459 Philadelphia W B Saunders Co 1916
12. CUMSTON C C. Congenital umbilical hernia. Med Rec 1905 66 491
13. DOTT N M. Clinical record of case of exomphalus illustrating embryonic type and its surgical treatment. Tr Edinburgh Obst Soc 1931-1932 pp 103-108 in Edinburgh M J 1932 August
14. FRANCO P. Traité des hernies. Lyons Thibault Payan 1561
15. FRASER J. Surgery of Childhood. Umbilical Hernia. Vol 2 p 773 New York Wm Wood & Company 1926 London E Arnold & Co 1926
16. FRESHMAN E. Congenital umbilical hernia. report of case of amniotic hernia. Lancet 1933 2 101
17. FRIEDRICH H. Die Behandlung der sogenannten Nabelschnurbrüche. München und Wehnschr 1934 81 675 abstracted in Arch f klin Chir 1933 177 249 (Kongressbericht)
18. GINGLINGER A. Contribution à l'étude de la pathogénie des hernies ombilicales du foetus. Gynec 1935 34 205
19. GORDON J W. Omphalocele congenitalis. J Michigan M Soc 1932 31 533
20. GRUBER G B. Ueber die Topographie hypoplastischer Nabelnerven und ueber die Lageverschiebung der Eingeweide bei angeborenem Nabelschnurbruch. Beitr z path Anat u z allg Path 1930 84 335
21. HEBERT A F. Hernia funiculi umbilicalis with report of 3 cases. Am J Obst & Gynec 1928 15 86
22. HEY WILLIAM. Practical Observations on Surgery. London T Cadell & W Davies 1803
23. KEITH, A. Malformations of human body from new point of view (Hunterian Lectures) III—Maldevelopments of the umbilicus. Brit. M J 1932 1 435
24. KLEINER B. Zur Frage der Bauchspaltung beim Neugeborenen. Zwei eigene Fälle. Monatschr f Geburtsh u Gynaek 1930 84 281
25. KRUMM, J F. Congenital hernia of umbilical cord with evagination and absence of sac. Am J Obst & Gynec 1931 22 442
26. LUDWIG F. Die operative Behandlung von Nabelschnurbrüchen. Ztschr f Geburtsh. u Gynaek. 1933 105 308
27. McCAGHAN, J J. Massive congenital hernia into umbilical cord. Memphis M J 1935 10 17
28. MASSABEAU G and GUTBAL, A. Lévisération ombilicale congénitale. Arch d mal de l'app digestif 1933 23 120
29. MAURICEAU F. Traité des maladies des femmes grosses et de celles qui sont accouchées. Paris, 1681
30. NIEBUHR W A, DRESCH C A and LOGAN F W. Hernia into umbilical cord containing entire liver and gall bladder successfully treated surgically. J Am M Ass 1934 103 16
31. PARÉ AMBROISE. The Work of that Famous Chirurgeon. Pp 303-304 959 London Th Cotes and R Young 1634
32. PAULLS AEGINETA. The Medical Works of translated by Francis Adams. Vol 2 London Sydenham Society 1846
33. POTT P. Treatise on Ruptures. 4th ed p 146 London Hawes Clarke & Collins 1775
34. PYBUS F C. The Surgical Diseases of Children. Chap IV—Umbilical Hernia p 18 Philadelphia P Blakiston's Son & Co 1922
35. REUSS A von and PARMELEE A H. Pathology of the Newborn Period. In Pfaunder and Schlossman's Diseases of Children, vol 1 pp 393-472 (Umbilical hernia pp 433-434) Philadelphia J B Lippincott 1935
36. RICHTER A G. Abhandlung von der Bruechen (new ed) Goettingen J C Dieterich 1785
37. SCANZONI F W von. Lehrbuch der Geburtshilfe. 3d ed, vol 3 p 1018 Vienna L N Seidel 1849-1852
38. SCARPA A. Traité pratique des hernies, Translated from the Italian by Bayol. Paris Gabon 1812
39. SMITH F R. Incarcerated hernia into umbilical cord in newborn. Bull Lying In Hosp New York 1932 13 407
40. STOECKEL, WALTER. Lehrbuch der Geburtshilfe. 3d ed pp 631 843 Jena G Fischer 1930.
41. VOGLF, F. Ueber einen geheilen Fall von Nabelschnurbruch. Wien med Wehnschr 1934 84 1113
42. WALRAVENS A. Contribution à l'étude de la hernie ombilicale chez le nouveau né et chez l'enfant. Paris Maloine 1902

THE INITIATION OF RESPIRATION IN ASPHYXIA NEONATORUM

A Clinical and Experimental Study Incorporating Fetal Blood Analyses

ROBERT A. WILSON, M.D., F.A.C.S., M. ALLEN TORREY, B.S., M.D., and
KATHERINE S. JOHNSON, A.B., Brooklyn, New York

THE initial gasp after birth (Fig. 1) is normally a vigorous inspiratory effort that opens the airways and some of the alveoli of the lungs. It is the most important event in every life, and is quite distinct from subsequent respirations. Once breathing, however irregular and shallow it may be, has developed, effective means of augmenting it are available. But there is no one generally accepted measure for initiating the first inspiration. If this does not occur spontaneously, the life or death of the child depends upon the measures employed.

The human fetus makes rhythmic respiratory movements *in utero* during the latter months of pregnancy. The onset of true respiration is believed to be caused by chemical rather than by physical factors. An explanation of this phenomenon satisfactory for our purpose is, that immediately after delivery, the placental circulation is markedly impaired by the contracting, retracting uterus. This results in a diminution of the oxygen supply to the baby and a marked increase of the carbon dioxide tension in the blood which stimulates the respiratory center to action. We are all born in a condition of apnea, but it is only when this state persists for an unduly long period of time that there is cause for alarm. In the majority

of prolonged apneas the constant increase in the carbon dioxide tension plus the measures employed by the obstetrician result in an inspiratory gasp, and apprehension is relieved. More and more often this favorable outcome is not experienced so easily—sometimes, not at all. It is in an effort to face this problem that this paper is presented.

We shall deal only with severe cases of respiratory depression and asphyxia. Clinically most of them correspond to what is known as *asphyxia pallida*, which term will be frequently employed. At other times we shall use the word stillborn indicating in either case a baby in a state of shock, very pale with a relaxed musculature and absent superficial reflexes, which has not breathed, but in which the circulation persists. As far as treatment is concerned there is another class of babies, those which are so deeply narcotized and anesthetized as to be in serious danger. Although these are not in shock and are blue rather than white, such a severe degree of depression presents a problem almost as serious as that of true *asphyxia pallida*.

Since the literature is replete with studies of the etiology and pathology of *asphyxia neonatorum*, these phases will not be dwelt upon. It is important, however, to discuss briefly changes in the blood which are found in *asphyxia neonatorum*. It is only when such studies, at least as far as the oxygen content is concerned, are furnished that a true picture of the gravity of a case can be obtained, and the success or failure of the method of resuscitation properly evaluated. Eastman has shown that in severe degrees of *asphyxia neonatorum* there is a reduction in the oxygen content of the fetal blood to extremely low levels. He has shown also that the serum

From the Department of Obstetrics and Gynecology, the Methodist Episcopal Hospital.

Presented as the annual Dr. Ernest S. Lewis Memorial Oration before the joint meeting of the New Orleans Gynecological and Obstetrical Society with the Orleans Parish Medical Society, at New Orleans, Louisiana, January 18, 1937. Read in full by invitation before the Washington Gynecological Society, Washington, D. C., January 25, 1936; the Obstetrical Society of Boston, Boston, Massachusetts, October 20, 1936; the Section of Obstetrics and Gynecology of the Royal Society of Medicine, London, England, April 16, 1937; and the North of England Obstetrical and Gynecological Society, Leeds, Yorkshire, England, April 23, 1937.

This investigation was aided by a grant from the Lindbergh Research Fund of the Methodist Episcopal Hospital, Brooklyn, New York.

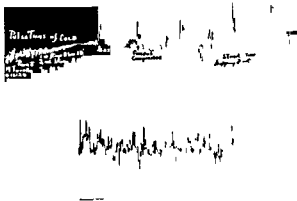


Fig. 1 Tracing of the first gasp and subsequent respiratory progress of a baby born spontaneously of a mother to whom no drugs or anesthetics were administered. Tracing commences 12 seconds after delivery. The gasp occurs about .6 seconds later. Effect of peripheral stimulation is clearly shown. Lower part of graph obtained $\frac{1}{4}$ hour later. Although the respirations are adequate for lung ventilation they are still irregular.

hydrogen ion concentration is markedly reduced there being at the same time a considerable increase in the carbon dioxide tension with usually a moderate decrease in the carbon dioxide content. When the latter occurs there is always an increase of endogenous lactic acid sometimes to very high levels (.45 to .90 milligrams per 100 cubic centimeters). Levels above the latter figure are practically always associated with fetal death. For several years previous to the publication of Eastman's studies we conducted similar investigations. Eastman's work was performed on blood from the umbilical artery and vein as well as blood from the maternal vein. He reported findings on normal and asphyxiated babies together with those born of deeply anesthetized mothers. Our studies were on the umbilical vein blood of normal and asphyxiated babies. The first group consisted largely of spontaneous births while the second was composed of many types of deliveries: the complicating effects of anesthesia and narcosis, as far as possible being avoided. The blood obtained under oil by a special technique, and analyzed by methods similar to those of Eastman, furnished results which paralleled his to a very close degree. An interesting finding in our series was the low oxygen

content in some babies which appeared to be breathing fairly well (Fig. 10) while in a fatal case (Fig. 3) the oxygen content was below 1 volume per cent.

Pressure from the laity has forced the profession to increase the use of analgesia and anesthesia. In many hospitals few labors are carried through with no drugs whatever. From a clinical point of view, it must be admitted that although the incorrect or excessive use of drugs may cause anxiety, as a rule such babies respond after a more or less prolonged period of apnea. Occasionally, however, a depression is encountered which is so deep that after a few shallow respirations the apnea recurs (Fig. 2) and such babies can be kept alive only with the greatest difficulty. The important point is, that although few lives are lost as a result of the use of drugs *per se* such babies cannot stand much additional asphyxia. If in such cases obstruction occurs in the cord, or there is partial separation of the placenta, compression of the head with forceps, etc., plus a long deep anesthesia, many of these babies will die. They would often recover from the narcosis or the asphyxia alone but are overwhelmed when one is superimposed upon the other. If a traumatic delivery with deep anesthesia is anticipated or other causes of asphyxia are present or likely to occur it would be safer to dispense with drugs.

THE INFLUENCE OF DRUGS ADMINISTERED TO THE MOTHER UPON THE ASPHYXIA OF THE NEWBORN

It is a poor use of drugs that in sparing the mother pain causes her to bear a baby that will not breathe. Resuscitation has an important place in the technique of the obstetrician but it is best that it should be needed as seldom as possible. It is not always successful.

All anesthetics, hypnotics, and narcotics diminish the sensitivity to stimuli. But these drugs vary widely in the relative degrees to which they depress sensitivity to the various kinds of stimuli.

The two most important forms of stimuli that come into consideration in parturition are first, those irritations of afferent nerves that produce pain, second, those chemical



Fig 2 Narcotized baby slowly relapsing into apnea. Respirations become progressively more shallow and the expiratory base line steadily falls. This indicates a decrease in muscle tonus and the closing of great numbers of alveoli as the chest wall collapses. This baby responded to carbon dioxide oxygen inhalations after respirations were re initiated.

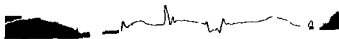


Fig 3 Tracing of an infant admitted after attempted forceps delivery at home. Ether anesthesia was used in a long difficult high forceps delivery, baby was limp and white and showed only a faint cardiac impulse. Every available method of resuscitation was employed without any improvement in color or tonus. Weak respiratory efforts occurring at irregular intervals. However five minutes after delivery this tracing was obtained with the oxygen mask in place. Baby was removed from the pneumograph and treatment was continued. Patient died 20 minutes later. Autopsy was refused. Blood obtained from umbilical vein immediately after delivery showed the following oxygen content, 0.8 volumes per cent pH 6.97.

stimuli that act upon respiration. In general the volatile anesthetics decrease sensitivity to afferent stimuli, while exerting comparatively little influence of a depressant character upon respiration unless administered in excess. Morphine (the drug traditionally relied upon to relieve pain by diminishing sensitivity to afferent stimuli) exerts a more powerful depressant effect in decreasing the sensitivity of the respiratory center to stimulation by the gases of the blood.

Obviously for use in parturition the drugs employed should have a maximum capacity to protect against pain with a minimum tendency to depress respiration. The failure to consider this point is probably due to the fact that until comparatively recent years the drugs chiefly employed were the volatile anesthetics. Beginning some 20 years ago, however, scopolamine with morphine came into use, and the more recent introduction of the barbituric acid compounds has led to a widespread and increasing practice of prolonged narcotization of the mother instead of temporary anesthesia.

Experience demonstrates that most drugs administered to the mother pass also to the child. Consequently the decrease of the sensitivity of the mother is accompanied by a decrease in the sensitivity of the respiratory center of the child to those chemical stimuli that normally induce and maintain respiration. How important this point is in actual practice is strikingly demonstrated by the figures recently published by Irving and his associates showing that, of all children born of wholly undrugged mothers, less than 2 per cent fail to breathe spontaneously, on the other hand with some of the drugs now frequently used, the depressant effects are so powerful that a large minority, or even a

majority (35 to 65 per cent) of the children born under their influence fail to breathe immediately at birth. Doubtless no obstetrician would admit that the use of such drugs had in his experience, actually cost the life of a child, but considering the extent of the present use of powerful respiratory depressant drugs in labor, there can be no question that there is a considerable mortality from this cause. This does not take into consideration those babies which are successfully resuscitated, but which later develop pneumonia from a continuance of partial atelectasis.

As an approximation the amount of protection against pain in relation to depression of respiration from drugs and gases in common use is as follows: paraldehyde, nitrous oxide, ethylene, ether, chloroform, barbiturates, scopolamine-morphine, morphine. When morphine is used, it should be in moderate dosage and should not be administered less than 2 hours before delivery (Fig 9). We have found experimentally and by clinical experience that babies are not easily depressed by the barbiturates, but if deep depression exists as the result of excessive dosage, the response if any, to the administration of carbon dioxide is poor. Ether is relatively safe unless present in the blood in high concentration for a long period of time. Nitrous oxide is of little danger to the baby if 15 per cent or more of oxygen is administered with it. If the oxygen ratio is much below this, however, asphyxiation of both mother and baby will occur. The value of paraldehyde is becoming generally recognized, no other available drug is so harmless

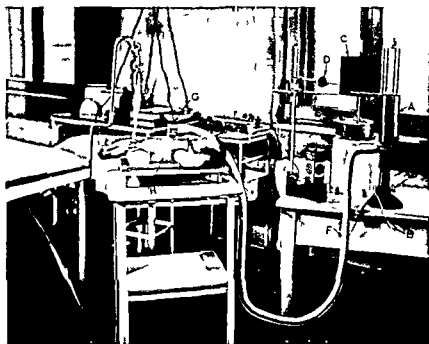


Fig 4 Pneumograph connected to recording apparatus. (Baby 3 days old) *a* Spirometer with scribing point in contact with revolving drum *b* clamp in place on small rubber tube through which air is forced into the system *c* recording drum *d* timer for recording seconds *e* electric timer *f* rubber tube *g* connection to which rubber bag is attached *h* hinged plate under which is inflatable rubber bag contacting front and sides of chest and abdomen NOTE When taking tracings immediately after delivery the pneumograph should be nearer the delivery table so that the cord need not be cut unless it is very short

OLDER METHODS OF RESUSCITATION

Artificial respiration Moncrieff states 'Artificial respiration in the sense of moving the chest even gently stands condemned in any form until respiration has begun, and once a breath has been taken it is no longer necessary. It does not reflect credit on the profession that this measure still is advocated in most of the standard textbooks of obstetrics. Artificial respiration depends principally for its effectiveness upon compression and a resulting decrease in size of the thoracic cavity. If the alveoli contain air, some of it is expelled so that when the pressure on the chest is removed, provided obstruction is not present, the elastic recoil plus the tonus of the diaphragm bring about an inspiration of air. It is of no avail to compress the unexpanded, solid, fetal lung, for upon releasing the pressure, air will not enter the dense viscus. In serious cases tonus is almost entirely absent, and if a little air has already entered the

bronchial tree, compression further restores atelectasis.

Summary Artificial respiration in the babies under consideration is condemned for its futility, exposure to cold, and the risk of injury. The peripheral stimuli which are incidentally involved in the various methods, are quite useless because they do not reach the center. The necessary stimuli must be chemical rather than physical.

Mouth to mouth insufflation This method of resuscitation dates back to antiquity. The principle involved is similar to that employed in the pulmotor and lungmotor. Mouth to mouth insufflation carries serious risk of infection and depends largely for success on the experience and skill of the operator. The latter's mouth serves as a mask and air is forced into the baby. It usually enters the stomach, but if sharp, short, repeated puffs are made, a little may enter the trachea, especially if the head is held in hyperextension.

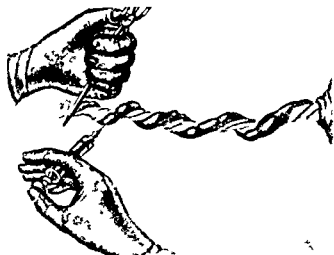


Fig. 5 Manner of injecting a respiratory or cardiac stimulant into the respiratory vein. The cord has been clamped and cut about 8 inches from the umbilicus. To facilitate the insertion of the needle, if possible a dilated or bulbous portion of the vein should be selected. It is well to withdraw a little blood in order to be sure that the needle tip is within the lumen.

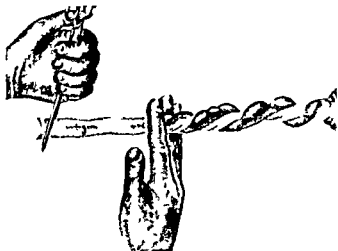


Fig. 6 Stripping of the umbilical cord. It is compressed between the fingers distal to the point of injection, and the fingers are then moved toward the umbilicus. The amount and rate of introduction of a drug into the general circulation are regulated according to the speed at which the fingers are moved.

Some observers believe that the carbon dioxide in the exhaled air which is between 3.7 and 5.5 per cent may be responsible for a favorable result. This is most unlikely. The oxygen (11 to 17 per cent) is of some value. This is indicated by improvement in the cardiac impulse sometimes noticed though no respirations occur. When a response is obtained, it is more apt to be due to the fact that a faint reflex is produced by the sudden distention of the larynx and trachea. In severe cases this reflex is not present so that the principal benefit that might be derived is from bringing into play the Hering-Breuer reflex by a marked distention of the bronchial tree. The pressure of air necessary to affect the stretch receptors, however, is likely to injure the delicate lung tissue.

Summary In the hands of the novice it is always dangerous, and even after long experience, the possibility of ruptured alveoli and infection is great. Occasionally a baby is saved by its use. It should be reserved, however, as a last resort after all other methods have failed.

NEWER METHODS OF RESUSCITATION

In order to evaluate intelligently the methods at present available to initiate respiration it is important to describe briefly certain experimental work performed by us

It was done in an attempt to answer the following question: Can the alveoli be safely opened and made available for gaseous interchange by means of gases under pressure in the trachea and bronchial tree (intrinsic pressures)? Conditions closely approximating those found in the living but non-breathing newborn can be obtained by using true stillbirths. Our material consisted of full term stillbirths in which death occurred less than 3 hours before delivery. These were immediately intubated with a leak-proof tracheal tube and the bronchial tree distended by oxygen. Five cases are reported here, a number sufficient to answer the question just propounded. The first was intubated for 20 minutes, a continuous pressure of 18 millimeters of mercury being used, the other 4 with the same pressure applied intermittently—4 seconds on and 3 off. A pressure as high as 18 millimeters was used in order to insure the thorough distention of the bronchial tree. The babies were immediately subjected to autopsy and the lungs in all 5 cases presented grossly no evidence of aeration. They immediately sank when placed in water. This is the more remarkable if we bear in mind that during the insufflation the thoracic cage and, to a lesser degree, the abdomen, were rhythmically expanded and deflated in a manner similar to normal respiration. When these

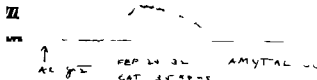


Fig. 1. Blood pressure response of the cat to injection of lobeline hydrochloride 1/20 grain into the femoral vein. Amytal was given intraperitoneally in sufficient amount to prevent pain and struggling. Note the transient rise of

pressure and increase of pulse pressure with subsequent slight fall below the base line. A return to normal is reached in 4 minutes.

and other cases in which the pressures ranged from 18 to 5 millimeters of mercury are published the microscopic findings and concomitant photomicrographs will be given in detail. It is sufficient to state that only relatively few alveoli contained air. When air was found the surrounding alveolar wall was usually torn, often communicating with other alveoli similarly damaged. Many were filled with blood. In 2 cases air blisters beneath the pleura were present, indicating extensive damage. The pressure was evidently too great for the friable fetal lung and resulted in serious damage, yet it was not adequate to aerate the lung and open the alveoli. It is logical to assume that a lower pressure, unlikely to damage the tissues, would be less effective in overcoming atelectasis. As a result of our experiments we can positively state that although the bronchial tree can be thoroughly distended the chest walls expanded and the diaphragm displaced the lung tissue itself cannot be adequately aerated even by pressures high enough to be injurious and destructive.

Drinker respirator. The efficacy of the Drinker respirator for respiratory depression in an adult or child which has breathed is beyond question. The important point in such cases is that alveoli are open so that, if respiratory movements are even an approximate prototype of the normal, air will enter and leave the alveolar spaces. Exposure is avoided, there is an absence of trauma and the rhythm is perfect. Although the respiratory movements are not exact duplicates of those controlled by impulses from the center, the imitation is close.

The diaphragm is an important factor in respiration, but with the Drinker respirator the amplitude of its descent is much less than in normal respiration. In spite of this numerous reports are favorable and show that good ventilation can be maintained. When this instrument is properly used, in moderately depressed babies, similar favorable results are obtained. We are faced with a more difficult problem in the case of the baby which has never breathed. The collapsed lung of the newborn is a structure composed of the bronchial tree, alveoli, blood vessels, fibrous and elastic tissue. It contains no air and does not open suddenly when the chest is expanded, but, rather, in sections of varied extent. With each early inspiration additional alveoli are aerated and, as this continues, more and more blood from the pulmonary artery circulates in the peri-alveolar capillaries. Gaseous interchange between the alveolar air and the blood now takes place so that increasing amounts of oxygen are carried to the center. Roentgenograms show that days and even weeks may elapse before the lung is completely expanded.

Coryllos and Birnbaum found a pressure of 14 centimeters of water necessary to inflate the atelectatic lung of the dog. This pressure was required solely to overcome the cohesion between the opposing surfaces of the collapsed alveoli. It does not take into account the additional pressure needed to overcome the resistance of the chest wall and diaphragm. This introduces an important principle, namely, that the initial effort necessary to expand the lungs must be considerably greater than the subsequent efforts required to maintain the expansion and continue ventilation.

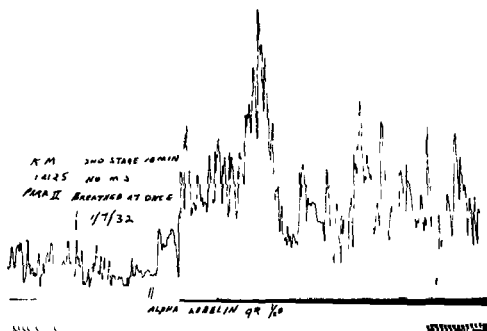


Fig 8 K M No 12125, weight 7 pounds 12 ounces, gestation 9 months, labor, 7 hours 30 minutes, second stage 10 minutes. No morphine or anesthetic was used. Delivery was spontaneous. Baby was in excellent condition. Breathed immediately. Lobeline hydrochloride 1/20 grain was injected 3 minutes after delivery for purposes of demonstration. This tracing shows a baby breathing irregularly but satisfactorily. A few seconds after injection a tremendous increase in the amplitude of most of the respirations commences. These extensive excursions of the thoracic wall result in the aeration of many additional alveoli with a proportional increase in pulmonary ventilation.

It should be clearly understood that we are only evaluating the use of the Drinker respirator for initiating respiration. Murphy, Wilson, and Bowman in 1931 reported the results in 35 infants treated with this apparatus. In 1932 Murphy and Sessums reported a larger series of 66 infants who failed to breathe promptly at birth. After careful clearing of the air passages the instrument was adjusted to give a breathing rate of 45 per minute for one group and 35 per minute for the other. The negative pressure employed was from 8 to 10 centimeters of water. Analysis of the results reported by these workers is not impressive. Fifteen of the 66 infants never breathed and 21 breathed before or during treatment only to die in the hospital. Although at least 13 of the 36 failures were premature, and most of these non-viable, the cause of death in as many as 15 full term or only slightly premature babies is reported as cerebral hemorrhage. Tentorial tears were observed in 5 of the cerebral injury cases, each of which was a breech delivery, but no men-

tion is made of the extent or location of the hemorrhage in these or the remaining 10, and, as cerebral hemorrhages are a common finding in asphyxial stillbirths (this condition being shown by Leff to be a result rather than a cause in most instances), death is not necessarily explained. In these deaths and others listed as being due to prolonged labor, prolapsed cord, etc., the important evidence as far as this method of resuscitation is concerned, namely, the extent of lung aeration, is not mentioned.

In 1933 Murphy and Bauer did report the results of postmortem examinations on the thoracic cavities of infants who died after treatment with a negative pressure of 8 to 10 centimeters of water. They were disappointed to find a high proportion of cases in which large areas of lung were unexpanded. They suggested, as a result of these findings, that better results would probably be obtained if a greater negative pressure were used. In view of these results and of others equally disappointing received in personal communica-

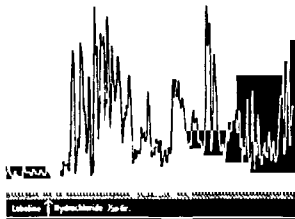


Fig. 9. Response of a morphinized baby unexpectedly born 6 minutes after $\frac{1}{4}$ grain of morphine sulphate had been administered to the mother. Delivery was spontaneous. No anesthetic was used. Baby was blue but manifested good tonus. Cardiac impulse was slow regular and strong. Graph was started 3 minutes after delivery—note the slow and shallow respirations with a tendency of expiration to lag. Expiratory lagging is a form of respiratory depression often encountered in drugged babies. There are short periods of expiratory apnea. Such infants unless treated vigorously suffer from atelectasis and are subject to neonatal pneumonia.

tions it is evident that the negative pressure should be increased. Serious damage however can be inflicted by high degrees of negative pressure, since it is possible to expand the chest to such an extent as to rupture every alveolus in the lungs. It has been suggested that better results would be obtained if, in addition to a greater negative pressure an alternating positive pressure were substituted for the return to atmospheric levels. This is not difficult to accomplish and is undoubtedly an improvement. The objection, even if this is done that the patency of the air passages is not properly maintained can be overcome by the simultaneous use of a tracheal tube. The principal difficulty is that, even in conjunction with a tracheal tube and alternating positive pressure the initiating negative pressure necessary to expand the collapsed lung is greater than has yet been suggested, and cannot be known until extensive experimentation has been performed. Assuming that the expansion is accomplished by an adequate but safe pressure it would then be important to diminish immediately the expansion force. This would make a trained attendant a

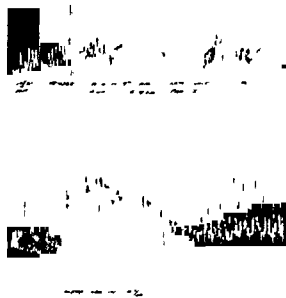


Fig. 10. N. H. No. 12039, weight, 8 pounds 3 ounces, gestation 9 months, labor 46½ hours, $\frac{1}{10}$ grain morphine sulphate 12 hours before delivery. Ether anesthesia was used. Delivery was by low forceps. Baby breathed promptly and although blue appeared to be in good condition. Tracing was started 12 seconds after delivery. A specimen of blood obtained 30 seconds later showed only 4.1 volumes per cent of oxygen. Two and one half minutes after delivery $\frac{1}{10}$ grain lobeline hydrochloride was injected to augment respiration. There is an increase in pulmonary ventilation of about 310 per cent, the greatest we have yet recorded. Of interest also is the comparatively low oxygen content in spite of little clinical evidence of asphyxia.

necessity. The respirator is cumbersome and expensive, so that even if the technique is eventually perfected it could hardly be available in many deliveries.

Summary. The Drinker respirator as employed today has little if any place in the initiation of respiration in the newborn. Piper, after years of use and observation with the Drinker respirator, came to the following conclusion: "This method of resuscitation based upon the principle of a vacuum can be of no value in those cases either blocked by a mucous plug or in which there is a definite condition of atelectasis. On the other hand, we are convinced that the Drinker apparatus for infants is of great value for the reviving of the newborn infant which has once had normal respiratory action." This is seen in prema-

tures who sometimes have syncopal attacks in the respiratory center, and deeply narcotized babies who breathe for a time and then relapse into apnea (Fig 2)

Lungmotors — pulmotors — resuscitators
These machines are of two types those employing intermittent positive pressure and those using intermittent positive and negative pressures It is not within the scope of this paper to consider their value for the adult or the child which has previously breathed, we are concerned only with the baby which has had no respiratory action and appears unlikely to breathe without definite assistance

For many years the idea of blowing air or oxygen into the lungs has appealed to science The earlier pulmotors were given an extensive and fair trial and, possibly, did save some lives They have been condemned on at least two occasions, however, by eminent commissions appointed to investigate their claims, and are little used today The damage inflicted on the living subject and the number of lives lost because of the delay in instituting other measures will never be known Brickley is quoted as having found tears and hemorrhages in the lungs of animals following their use There is no question that many of the resuscitators on the market today are superior to the original pulmotors They are safeguarded against excessive pressures, but the reasons which counsel their abandonment have not changed On March 14, 1935, an English authority, Moncrieff, speaking before the Royal College of Physicians in London, on respiratory failure and resuscitative measures, stated "Positive pressure inhalatory methods involving the use of a mask and pump are unsafe in most instances and quite unsuitable" Most of these machines are clumsy and expensive and even if they were efficient, would not be commonly found in smaller hospitals, and would practically never be on hand in the home where the majority of deliveries still occur

Kreiselman, Kane, and Swope have reported good results with a resuscitator which they designed and developed By means of a tube running to the back of the mouth, attached to a tight fitting rubber mask, repeated blasts of oxygen are injected under carefully

regulated pressures Its mode of action appears to be identical with that described under mouth to mouth insufflation without the disadvantages and dangers of the latter In order to evaluate their work properly, detailed, microscopic studies on the lungs of fresh stillbirths treated with this machine and then immediately subjected to autopsy should be published This also applies to any resuscitator which is claimed to open alveoli

It is not difficult to account for the good results reported by some clinicians in their experience with resuscitators If the apparatus employs positive and negative pressures, as most of them do, it is generally demonstrated by means of a non-elastic bag made of rubberized fabric The bag is inflated until it resists further distention and creates a back pressure which then actuates a reversing mechanism so that an aspirator is brought into play and suction produced When the bag is empty, the aspirator is automatically shut off, and inflation is again instituted The bag is thus successively inflated and deflated Inflation and deflation of a bag is deceptive, because the bag, unlike the air passages of the body, offers no resistance until full As soon as the inspiratory blast meets an obstacle in the air passages, it is automatically cut off and turned into expiration, thus efficient inspirations are not performed There follows a rapid clicking of the mechanism back and forth without any visible excursions of the chest and abdomen Some observers believe that alveoli are gradually opened during this clicking process, but from our experiments on fresh stillbirths we are convinced that the alveoli cannot be opened in this manner

When the opportunity to try out a new resuscitator presents itself, some obstetricians are likely to use it on baby after baby, which after delivery present a period of apnea, regardless of whether such treatment is really necessary (i.e., relaxed musculature, shock, absence of reflexes, failing circulation) As comparatively few babies manifest these findings but, rather, a mild depression as the result of drugs and anesthesia, it is inevitable that the results will be good An objection to the use of these machines is that valuable time is lost before such instruments are put aside

The lapse of even one minute in the case of a severely damaged respiratory center will result in further damage and may render the cells irreversible. Schmidt believes this to be due largely to the accumulation of products of incomplete oxidation. Once it has occurred, the full restoration of oxygen will fail to bring back functional activity because the altered cells are no longer able to utilize the gas.

Summary At times resuscitators appear to give results in cases for which they are not needed. They fail in the serious cases under consideration and are contra indicated if they employ suction, for if this acts at all, it tends to deflate the lungs and restore them to atelectasis.

Inhalators The treatment of asphyxia with an inhalator usually consists of the inhalation of varying percentages of carbon dioxide and oxygen. Oxygen not only nourishes but sensitizes the cells of the respiratory center, while carbon dioxide, if present in sufficient quantity, stimulates them. Respiratory stimulation may be reflex or chemical. This form of treatment relies on the latter. Without going deeply into the chemical control of respiration it should be pointed out that, although a slight diminution in the oxygen content of the blood temporarily stimulates the center, a further diminution renders it less sensitive to whatever carbon dioxide is present. When this condition persists, oxygen should be restored as rapidly as possible, but, until this has been accomplished, an increase in the carbon dioxide tension will provide increased stimulation and largely compensate for the oxygen lack. If the oxygen content remains relatively low for a long period of time, which is the case in the later months of gestation, a considerable increase in the carbon dioxide pressure, a normal finding during these months, may not be adequate to initiate or continue respirations, as it has been shown by Eastman that the fetal center becomes dulled or insensitive to considerably increased tensions of carbon dioxide. In order to improve the function of the center the oxygen supply must be fully restored and, for a time, the carbon dioxide tension, already high, markedly increased. It is, in part, upon these facts that the value of the inhalator for the poorly breathing baby is

based. As a rule a mixture of carbon dioxide and oxygen containing 10 per cent of the former is sufficient to augment respiratory movements, but in some few cases in which the respirations are very shallow, in spite of a high carbon dioxide tension, mixtures containing as much as 20 or even 30 per cent should be employed for a short time. As the oxygen revivifies the center, less carbon dioxide is needed, thus it should be progressively cut down to 10 or 7 per cent.

As early as 1920 Henderson (15) advocated the use of such mixtures. On numerous occasions since, he and many others have elaborated upon the subject so that, as far as the asphyxiated but breathing baby is concerned, inhalator therapy, when obtainable, has practically supplanted other methods. In such a case we rely on the infant inhaling the gases, thus producing stimulation as well as oxygenation of the center. The inhalator has saved, and will continue to save, countless babies, yet it can actually do harm. This statement is based upon the fact that the inhalator is useless in a stillborn child, for, placing a mask over a baby's face, even when the gas is under pressure, will not assure its entering the lungs. Valuable time is thus lost if the limitations of the inhalator are not appreciated.

Summary The inhalator is the best and safest means we have for saving the life of the asphyxiated but breathing baby, and is also of value as a neonatal treatment for the prevention of atelectasis and pneumonia. It is, however, of no avail in itself as a means of initiating respiration (Cases 7 and 10, Table I).

Laryngeal intubation and insufflation The digital insertion of a flexible rubber tube into the trachea has been practiced for many years, ease of introduction depending principally on the presence or absence of a laryngeal reflex. If present, it indicates a comparatively mild asphyxia so that although insertion might be difficult, it is rarely needed. When the reflex is absent, there are no respiratory efforts and the skeletal muscles are markedly atonic. Because of this such babies can be intubated with little practice—DeLee, for example, mentions a simple technique. In 1928 Flagg described a technique for introducing a metal

tube into the trachea by means of a small electrically lighted laryngoscope. The tracheal tube is connected to a water manometer which is in turn connected with a supply of carbon dioxide and oxygen. The manometer indicates the pressure of the gases in the tube and is so adjusted as to act as a blow-off valve if an excessive pressure is used. We have found that 12 millimeters of mercury is the highest pressure that can be used with safety. Blackley and Gibberd have recently suggested a somewhat similar technique employing a rubber catheter instead of the rigid tube. Although trauma may be inflicted if the laryngeal reflex is present, in its absence both methods are easy and safe.

The lungs of the stillborn are dark in color, do not crepitate, and sink in water. With the first inspiration the thoracic wall expands and the diaphragm descends so that a disproportion is created between the thoracic cavity and the solid lungs. In the absence of obstruction, air enters the bronchial tree and infiltrates into the alveoli. There is little or no negative pressure in the pleural space at this time, since insufficient disproportion between the lungs and the chest cavity exists. Later, as a result of the rapid growth of the ribs and vertebral column, a real disproportion is present, which, because of the elastic recoil of the lung tissue, produces a definite intrapleural negative pressure.

To most obstetricians intratracheal insufflation has for its principal object the forcible expansion of the lungs. It has been previously stated that the alveoli cannot be safely opened in this manner. The preceding paragraph described nature's way of opening the lungs, which, in most respects, is at variance with the concept of using gases under pressure in the trachea.

This does not mean that insufflation is not of great value. On several occasions we have observed that when oxygen is insufflated into the trachea, there is a definite improvement in color. If the insufflation is performed with a tight fitting tube and a pressure as low as 5 millimeters of mercury, the bronchial tree is distended, the chest increased in size, and the absorption of oxygen is even more rapid. Using this pressure and technique we kept a

baby alive for 2 hours although it never breathed and autopsy revealed no open alveoli. This is of great significance. Intermittent pressure is recommended by Flagg but Blackley and Gibberd state that this is not necessary. They feel that if respiration commences, expiratory movements against a positive pressure assist in the aeration of the alveoli and to some extent are imitations of the valuable crying efforts. Intermittent pressure is probably of value, however, as the rhythmic expansion of the bronchial tree may bring into play the Hering-Breuer reflex. Although this reflex is absent in severe cases, it will return if the circulation improves sufficiently as a result of the absorption of oxygen by the mucosa lining the trachea and bronchioles.

Summary Intubation is safe and easy to accomplish in the severely asphyxiated baby, permitting thorough aspiration and providing an excellent airway. Essentially, it is the extension of an inhalator into the lungs. It should not be used in an attempt to open the alveoli by direct attack.

Tilting boards Eve and Cornish have devised seesaws on which the patient is laid and rocked through an angle of 30 or more degrees. Henderson (14) in recent experiments on dogs found that the volume of air moved in and out of the lungs by this rocking method is much less than that displaced when the chest is compressed by hand. As such pressure is useless when there is no air to expel, it would seem that the rocking method is of little or no value in initiating respiration.

Intravenous resuscitation By this is meant the initiation or reinitiation of respiration utilizing a substance injected into the blood stream. This method depends principally either upon direct stimulation of the respiratory center or the lowering of the response threshold so that a previously dulled center is rendered more sensitive to the prevailing carbon dioxide in the blood. In 1928 one of us (R A W, 39) presented a preliminary report on the injection of a respiratory stimulant into the umbilical vein for the treatment of asphyxia neonatorum.

In the search for a satisfactory agent much time was devoted to the study of drugs com-

TABLE I—SUMMARY OF THE IMPORTANT FACTS CONCERNING THE RESUSCITATION ON TEN NEWBORN INFANTS SUFFERING FROM ASPHYXIA PALIDA—Continued

Infant	Cause of asphyxia	Delivery	Cardiac impulse	Oxygen content (volumes per cent)	pH	Simple measures of resuscitation (minutes)	Dose of lobelia (grains)	Elapsed time from stripping to first inspiration (seconds)	Response	Auxiliary measures	Apparatus used before rhythmic breathing	Subsequent treatment	Last observation
7 Term	3 hours of cord around neck Fetal heart irregular for 2 hours before delivery ery very slow and faint for last half hour Not heard during pains Fingers extended	Difficult mid forceps	Very slow and faint (15 volts per minute)	6	7.02	5 Plus Thorough suction. Clamp on tongue. Frequent deep stripping. Mouth to mouth respiration (Vesicular tubing) Artificial respiration by pressure on chest and abdomen with inhalator over mouth and nose. (Rhythmic compression of inhalator bag). No response	16	0	After failure of previous methods intravenous therapy attempted. Cord short and could not be pulled. Reversal stripping permitted successful injection. Mild death was imminent. Very slight increase of tone followed by weak gasp. Short apnea then weak irregular respirations. These improved slowly when inhalator respired.	Heat Inhalations of CO ₂ 7%—O ₂ 95% for 30 minutes	12 hours	CO ₂ 7%—O ₂ 95% 3 minutes every 2 hours for 24 hours twice daily for 8 days whiskey strychnine	13th day normal
8 Term	Breach extraction. Imbedded about loosely extended arms		Slow and weak	3.6	7.20	No response	2-3	Less than 10	Deep inspiration followed by deep irregular respirations			Continuous O ₂ by funnel Syringe tap	Died after 24 hours Cerebral hemorrhage with tentorial tear Autopsy
9 Term	Difficult breach extraction	A.C.H.F.*	Imperceptible?	1.0	7.06	No response	1-2	6-7	Stiffening of body Weak gasp followed by several shallow respirations. Sudden improvement in color and deepening of respirations. Latter became labored just before withdrawal of tracheal mercury. Cord sound. Cardiac impulse rapid and strong. Complete restoration of tone	Tracheal sound (Flag) CO ₂ 20%—O ₂ 80% intermittently for 15 minutes. (5 minutes) Cord then stripped Above continued for 1 minute after initial gasp. Sound withdrawn and inhalator applied CO ₂ 7%—O ₂ 95% for 5 minutes. Repeated 15 minutes later (Combination technique)	90 min	Inhalations CO ₂ 7%—O ₂ 95% 5 minutes twice daily for 5 days	15th day normal except for fractured clavicle
Average oxygen content				1.955 volumes per cent									
Average pH				7.996									

*A.C.H.F.—after coming head forceps

TABLE I—SUMMARY OF THE IMPORTANT FACTS CONCERNING THE RESUSCITATION OF THE NEWBORN INFANTS SUFFERING FROM ASPHYXIA TALIADA—Continued

Infant	Cause of asphyxia	Delivery	Card. c impulse	Oxygen content (volume per cent)	pH	Simple measures of resuscitation (minutes)	Dose of lobeline (grains)	Elasted time from stripping to first inspiration (seconds)	Re: p: nae	Auxiliary measures	Approximate interval between breathing	Subsequent treatment	Last of observation
10 Term	Long dry labor Cord tight around neck	Difficult w/ forceps	Slow faint at first regular	8	7.08	4 Plus focal ling tract on tongue and artificial respiration with inhalation and positive pressure apnoea. All reflexes increased and became more active. Combinations of all these then employed. A total of from 8-10 minutes elapsed before cord was knipped. Sound respiration then tracheal tube inserted. Total 15 minutes.		6	Marked stiffening of body and small or with tonic. Sleep in period of apnoea. Several tubes in 1 minute and 1 then repositioned. Tracheal tube removed. 1 sound frequency by irregular sucking movements. With intubator in place improvement was apparent.	(Combinations similar to preceding cases. Exact tracheal tube removed in 15 minutes)	Several hours	Intubation of O.U. 7.0 5 minutes twice daily for 3 days	14th day normal
Average oxygen content 1.055 volume per cent Average pH 7.07													

monly deemed to be analeptics and respiratory stimulants, such as strychnine, epinephrin, caffeine sodio benzoate, atropine, ephedrine, etc. Either there was no respiratory stimulation following injection or so little that they would be of little use in a severely asphyxiated baby. Undesirable and dangerous side actions were often found particularly with the dosage increased in order to obtain more respiratory effects.

It is necessary to summarize the results of hundreds of animal experiments in different types and degrees of narcosis and asphyxia in a short space. Only two drugs were found to be good respiratory stimulants. Pyridine B-carbonic acid diethylamide (coramine) and lobeline hydrochloride. The former increased considerably the rate and amplitude of respiratory movements. On a number of occasions it initiated respiration after the experimental production of apnoea. Frequently, however, severe and sometimes fatal convulsions occurred even when recommended dosage was used. Moncrieff speaks of similar convulsions in children, therefore we have not felt justified in using it intravenously in the newborn. These convulsions do not usually occur in adults and older children when the drug is injected subcutaneously. No further consideration was given to coramine as the subcutaneous injection of this or any other drug in stillborn babies is doomed to frequent failure because of the weak circulation and the consequent lapse of time which results between injection and effect. If a favorable result is to be obtained, within a few seconds after injection, it is possible only by intravenous therapy. (Pentamethylentetrazol—metrazol and picrotoxin are known to be analeptics. In the case of the newborn extreme caution is advisable for these drugs are also convulsants.)

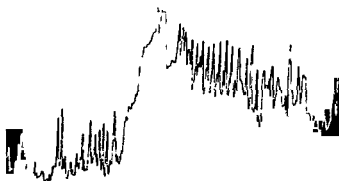
There is general agreement among those who have had experience with lobeline that it stimulates respiration. There is some difference of opinion as to its effectiveness in severe degrees of narcosis and asphyxia. Competent observers (1, 6, 8, 10, 16, 32, 33, 35, 36, 37, 38, 39, 40) have reported more or less favorably, yet others (11, 18, 20, 22, 27, 28, 31, 34) advised against its use. We have given it a

thorough and impartial trial both clinically and in the laboratory, using a preparation of lobeline hydrochloride¹ The results as a whole have been impressive, especially in severe asphyxias

Graphs of the apnea and early respirations of the newborn have not been previously produced, yet they are absolutely necessary if we wish to have impartial and permanent evidence of the condition of a baby before and after resuscitation As there was no reliable method for recording the respiration of the newborn immediately after birth, it was necessary to devise an apparatus for that purpose It consists of a receptacle in which the infant is placed immediately after delivery Movements of an infant's chest and abdomen are transmitted to a spirometer carrying a scribing point which in turn writes on a drum (Fig 4) By means of this apparatus it is possible to study, not only the effects of drugs and gases as resuscitant agents, but also the effect on the baby of drugs and anesthetics administered to the mother before delivery Tracings can be started as soon as 7 seconds after delivery and from dozens which have so far been obtained a few representative ones will be presented

In the remainder of this article we shall prove by means of the aforementioned graphs that lobeline will heighten the respiratory efficiency of the normally breathing baby, that it will rapidly overcome respiratory depression due to morphine, that it will produce such a marked expansion of the thoracic cavity as to greatly diminish, if not entirely remove, residual atelectasis, lastly, that it will actually initiate respirations in serious asphyxias The graphs of the latter condition are fortified by detailed protocols of the resuscitation of 10 cases of asphyxia pallida with concomitant fetal blood studies (Table I) The best technique of injection, blood pressure response, method of action, dosage, and safety will be considered

In order to duplicate these results the drug must be introduced directly into the blood stream, a most rapid method for reaching the center Even in the breathing child, carbon



Alpha lobeline injected
A and marked 1 week Baby

Fig 11 E S No 12543, weight, 6 pounds 1 ounce, gestation, 9 months, labor, 19 hours Delivery was spontaneous No anesthetic was used Cord was twice around neck Baby breathed at once, but remained blue Three minutes after delivery 3/40 grain lobeline hydrochloride was injected Note marked expansion of thorax which indicates that any atelectasis has been, at least partially, overcome

dioxide administered with an inhalator finally reaches the center in this way (Its entrance into the lungs and passage through the alveolar walls is an intermediate step) Therefore, it is logical to introduce the stimulating substance directly into the blood if, as it has been previously shown, the lungs are solid In grave asphyxias the lingual death zone is a barrier to the passage of gases into the trachea The desired effect need be of short duration only because, if respiration commences and the airways are patent, a few inspirations will open up alveoli to oxygen and carbon dioxide Treatment is then continued as it would be on any asphyxiated but breathing baby

Any method of resuscitation should be as simple as possible This is particularly true in obstetrics because so many deliveries take place in the home One should also keep in mind the confusion and excitement that often attends the birth of a stillborn child The superficial veins are too small to be readily available, and injection into the longitudinal sinus or heart chamber are radical procedures and should not be lightly undertaken The umbilical vein offers the most convenient place of injection Only when the cord has

¹For a detailed history and description of this drug the reader is referred to the standard textbooks of pharmacology

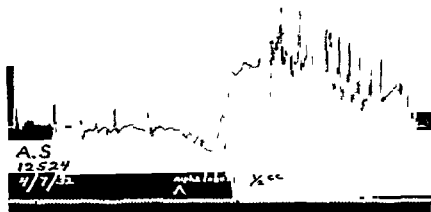


Fig 12 A.S. No. 12524 weight, 7 pounds 12 ounces gestation, 9 months labor 16 hours—1/6 grain morphine sulphate was given 6 hours before delivery. Ether anesthesia was given. Delivery was difficult, by low forceps. Baby showed severe asphyxia, was limp and pale. However faint efforts at respiration followed aspiration. Lobeline hydrochloride, 3/40 grain, was administered. Tracing was started 5 seconds after delivery. This baby was markedly depressed the respirations consisting of irregular gasping efforts. Following injection, the status completely changed. There is a marked expansion of the chest true, deep respirations were established with good pulmonary ventilation. Recovery was complete. The umbilical vein blood contained 23 volumes per cent of oxygen.

been cut close to the child need other sites be considered. We make it a practice always to leave the cord long until respirations are well established.

The following improved technique is the one recommended for general use. Although not difficult it must be correctly understood and performed in order to obtain a speedy and satisfactory response.

Immediately after delivery the baby is handed to an assistant who holds it preferably by the feet with the head down. The cord should not be cut unless it interferences with delivery or is very short. As previously mentioned it should not be cut close to the umbilicus. Thorough aspiration with a flexible rubber tube is performed after which a careful appraisal of the baby is made. Particular attention should be paid to the color, muscle tone, and the strength and rate of the cardiac impulse. If resuscitation is decided upon the cord is inspected and a good injection site determined. This should be preferably between 6 and 8 inches from the umbilicus. The cord is then doubly clamped about 1 1/2 inches distal to the chosen injection site and cut between the clamps. The remainder of the technique may be carried out on a table or in a heated receptacle but we prefer to perform it without moving the baby keeping it in its inverted position. There is less delay and less danger of a break in asepsis. An exception to this is made in the case of grave asphyxia in which a more elaborate technique in conjunction

with a tracheal tube is used. This will be described later. If lobeline is the resuscitating agent to be used, 1/10 grain of the hydrochloride is injected into the umbilical vein (Fig 5) and the cord compressed firmly between the first and second fingers adjacent to the clamp. The column of blood and drug in the vein is milked toward the umbilicus (Fig 6) (Epinephrin and other drugs may be similarly administered.) The first half of the trapping is done rapidly to avoid delay. (The drug has not yet reached the child.) The milking is then continued slowly and progressively until a respiratory response results. Once breathing is well established, any drug remaining in the vein is removed by tying and cutting the cord near the umbilicus. According to the preference of the operator an inhalator mask may be applied before the trapping or after respirations have been induced. Injection into the cord distal to the umbilical arteries is of no avail. In rare cases injection may be difficult if the vein is small or collapsed. The latter condition is easily corrected by having the assistant compress the cord between the fingers at the umbilicus and slide them a short distance toward the clamp. This causes the vein to stand out clearly.

Identification of the umbilical vein. (1) The umbilical vein is more superficial and larger than either individual artery. (2) The umbilical vein rarely always discloses points of dilatation and varicosity and this in conjunction with its greater size will identify it. Inject at an area of dilatation.

Figure 7 is a blood pressure tracing from the external carotid artery of the cat and is rep-

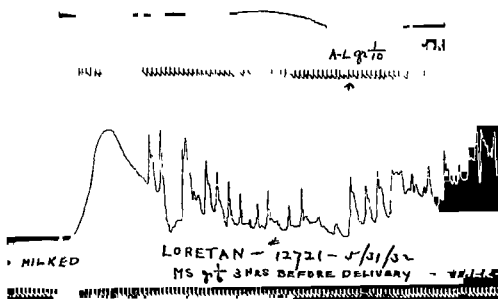


FIG 13 E L No 12721 weight, 8 pounds, gestation 9 months, labor, 18 hours, 20 minutes. Three hours before delivery 1/6 grain morphine sulphate was given. No other medication was used. Delivery was spontaneous. Ether anesthesia was used. Baby was white, completely limp, and presented a picture of the most severe state of asphyxia pallida. Only slow and very weak cardiac pulsations could be detected. The cause of the asphyxia was undetermined. One and one half minutes after delivery 1/10 grain lobeline hydrochloride was injected. Twenty one seconds later the cord was rapidly and completely milked. Fifteen seconds thereafter a deep and powerful inspiration occurred. The tracing shows that following delivery no respiratory efforts were made. The amount injected was relatively large, and the respiratory muscles were thrown into a temporary fixation. Relaxation of these muscles followed and then respirations began. That the respiratory center had been severely depressed is indicated by the newly established respirations which are seen to be markedly irregular. The important point is that the baby is breathing which should be contrasted with the apnea before injection. Complete recovery followed.

The degree of asphyxia is shown by the following blood findings: oxygen content, 0.9 volumes per cent, pH 7.01.

representative of many others. A rather sharp rise followed by a slow fall, sometimes to a little below the base line with a gradual return to normal, has been a relatively constant finding. The blood pressure effects are not significant. Clinically there has been no evidence of either cardiac stimulation or depression. The question is of little importance because as soon as a few respirations have occurred, the oxygenation of the blood brings about an immediate improvement in the circulation. Figure 8 illustrates the effect of lobeline, administered for purposes of demonstration, on a normal, breathing baby. Figure 9 shows an excellent result on a morphinized infant. It is apparent at a glance that there is a tremendous expansion of the thorax with a consequent opening of innumerable alveoli. The

flow of tidal air and gaseous interchange with the blood are therefore proportionately increased. Figure 10 is a graph taken for teaching purposes. It demonstrates a marked change in rate and amplitude and a corresponding increase in respiratory efficiency of about 310 per cent. Figure 11 illustrates a considerable expansion of the thorax. A change of respiratory style has been brought about. Breathing now takes place with the chest in an inspiratory position. Any atelectasis has been, at least partially, overcome.

The graphs have been presented solely to furnish pharmacological evidence. There is no intention to indicate that the treatment was necessary. On the other hand it would be difficult to deny that the babies in question were not better off as a result of the respira-

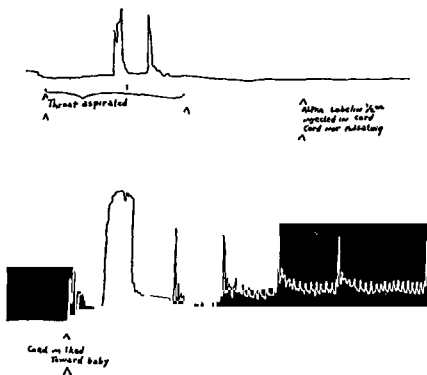


Fig 14 A F No 12535 weight 6 pounds 13 ounces gestation 9 months, labor 16 hours 7 minutes Two hours before delivery $\frac{1}{4}$ grain morphine sulphate was given Gas-oxygen ether anesthesia was used Delivery was spontaneous There was a tight knot in the cord Baby was pale and flaccid There were no pulsations of the cord A slow and faint cardiac impulse was discernible The condition was judged to be critical One and three-quarter minutes after delivery $\frac{3}{40}$ grain lobeline hydrochloride was injected The cord was stripped 52 seconds later This copy of an original graph shows a prolonged apnea The two movements of the scribing point before injection should be disregarded They were caused by pressure on the bag during aspiration The apnea continued until milking which resulted in a deep inspiration maintained for 6 seconds Then a series of inspirations at intervals of about 17 seconds interspersed with shallow respirations followed The latter tended to increase in depth and rate CO_2 7 per cent— O_2 93 per cent administered after removal of infant from pneumograph Recovery Oxygen content was 13 volumes per cent pH, 7.06

tory stimulation Those graphs which illustrate the initiation of respiration (Figs 12, 13, 14) are in a different category The last two, particularly, in conjunction with the clinical picture and blood findings, indicate apneas of a serious nature Although it is impossible to prove it, it is highly probable that the treatment saved their lives In our experience the best results are obtained from centers depressed by morphine, chloral hydrate, and the barbiturates In moribund babies only irregular gasps may follow injection, but these are sometimes adequate to save life In serious but less profound asphyxias, vigorous and fairly regular respirations are initiated The

visible effects of the drug disappear in from 2 to 4 minutes

Lobeline acts by lowering the threshold of the center to the carbon dioxide present in the blood The first inspiration takes place within 15 seconds after milking the cord, if the center is not irreparably damaged It is imperative that the drug be correctly administered Before the respiratory response, there is a stiffening of the entire body frequently resulting in a mild opisthotonus The inspiratory gasp follows almost immediately These findings are so constant that if they are absent, it is almost conclusive evidence that the drug is not in the general circulation The increase of

tonus is itself of great value. Certain writers have opposed the use of drugs because of the danger of overdosage. This is not a valid objection because, if it were, it would be necessary to discard in many diseases, remedies which are poisonous in excess. Overdosage with the hydrochloride does not result in depression, but only in a temporary apnea. This is due to a fixation of the chest and diaphragm in the inspiratory position as a result of excessive stimuli from the center (40). This apnea is in itself harmless except that the desired pulmonary ventilation does not occur. Since delay in pulmonary ventilation is injurious, the apnea for this reason is undesirable. It will not occur if the dosage is correct. The most satisfactory results are obtained with $1/20$ grain, although $1/40$ grain elicits an excellent response in mild cases. As high as $3/20$ grain may be employed although with the larger amounts the aforementioned apnea may be encountered. In order to allay apprehension about overdosage, we may state that after careful tests on animals we have used in babies as much as six times the recommended dose without permanent ill effects.

In this institution up to January 1, 1937, lobeline hydrochloride has been injected into the circulation of 340 babies. A detailed analysis of these cases will be published in the future. It should be stated that many of the injections were administered to normal babies in order to secure additional data. All treated babies were subsequently observed by competent pediatricians. In no instance did side effects such as vomiting or convulsions ensue, and no infections of the umbilicus were noted.

Summary Intravenous resuscitation appears to have only a limited field in the poorly breathing baby but is of great importance in the stillborn. Its rôle is almost exclusively that of initiation.

Two highly desirable aims, namely an increase of body tonus and a favorable influence on the respiratory center, have been satisfactorily achieved by lobeline hydrochloride, which has been found to be safe and free from side effects. Its use in combination with other drugs is, at present, under investigation.

Important advantages of this method are economy, simplicity, and rapidity of action.

Disadvantages are the transient nature of the response and the necessity for perfect asepsis.

TECHNIQUE

The most important methods of resuscitation have been presented. It is apparent that no one of them is entirely satisfactory. We have found that in combination, however, most encouraging results may be obtained, and suggest the intravenous use of a respiratory stimulant in conjunction with tracheal insufflation and the subsequent application of an inhalator. The technique, important particularly in asphyxia pallida, is as follows:

Immediately after delivery as much material as possible is aspirated with a rubber catheter. The umbilical vein is then injected and stripped to just short of the half way mark (Figs 5 and 6). A second clamp is, however, applied here to prevent the blood from returning toward the site of injection. So far the initiating substance has not entered the circulation, but has been made ready for subsequent use. The next step consists of introducing a laryngoscope, the baby lying on a table with the head over the edge in hyperextension. Suction of the larynx and trachea is performed, using a hollow sound designed for this purpose, and the tracheal tube then inserted. The latter insufflates a mixture of carbon dioxide and oxygen in the proportion of 20 per cent to 80 per cent, respectively, under intermittent pressure (5 to 12 millimeters of mercury). If preferred, lesser percentages of carbon dioxide or pure oxygen may be used. The initiating drug is slowly milked into the circulation by further stripping of the cord, a sufficient amount being introduced to bring about a definite gasp and subsequent respirations. The carbon dioxide entering the newly opened alveoli results in an increase in depth and frequency of the respirations. The oxygen quickly improves the circulation and also renders the respiratory center more sensitive. When high percentages of carbon dioxide are used, the tube should be withdrawn in from 1 to 2 minutes after breathing has commenced (Cases 9 and 10, Table I), the tongue pulled forward by a clamp or suture, and an inhalator placed over the face. If the lower percentages or pure oxygen are favored, the tube may be left in place much longer. The inhalator supplies percentages of about 7 and 93, respectively. This treatment is continued until the child is out of immediate danger. In severe cases it is advisable to administer these gases at intervals for approximately 5 days.

In 2 cases which came under the care of one of us (R. A. W.) the babies showed no signs of life. Epinephrin was injected directly into the heart. As a result, some faint cardiac pulsa-

TABLE II—RESPIRATORY DEPRESSION OCCURRING IN 17,860 LIVE BIRTHS, INCLUDING 1,051 PREMATURES¹

	Cases	Per Cent
Mild asphyxia	8	
Moderate asphyxia	215	
Severe asphyxia (including asphyxia pallida)	63	
Total number which did not breathe promptly at birth	381	2.13
Intra-uterine therapy (lobeline—alone or in combination) for the initiation or re initiation of respiration—		
Mild asphyxia	23	
Moderate asphyxia	143	
Severe asphyxia (including asphyxia pallida)	68	
Total	234	
Failure to respond after injection or response followed by death within 2 weeks—		
Asphyxia and congenital malformation	2	
Asphyxia and hemorrhagic disease	1	
Asphyxia and cerebral hemorrhage	6	
Asphyxia	4	
Asphyxia atelectasis and prematurity	10	
Total	23	9.82

Prematures of less than 28 weeks gestation are omitted. Also all dead born. The absence of visible or audible cardiac pulsations was the principal criterion in cases of doubt. The majority of doubtful cases received an injection of epinephrin directly into the heart. On rare occasions a response was obtained. The case was then treated and classified as a live-birth.

¹These statistics compiled by Dr. Martin Z. Glynn.

tions were observed, the preceding technique initiated respirations, and both babies recovered. A number of cases have been reported in which life was saved by the intra-cardiac injection of epinephrin. If death is not absolutely certain epinephrin should always be tried.

This combined technique embodies advantages of important methods with few of their disadvantages. The tracheal tube overcomes obstruction and, if gases are employed, brings them into the lungs under a safe pressure, ready to be absorbed at the first opening of alveoli. No attempt is made to dilate the alveoli forcibly within. The use of an inhalator when respirations have been established, is an accepted procedure. It is not imperative to employ varying percentages of carbon dioxide although some writers have claimed benefits from the brief use of a high concentration. This has been challenged (9). A 5 to 7 per cent strength is effective and when used, does not require the early removal of the tracheal tube. The technique is effective in any case sufficiently serious to have a diminished or absent laryngeal reflex.

The importance of thorough suction cannot be overestimated. The initial inspiration may otherwise result in inundating the bronchial tree with liquor amnii, blood, meconium, etc., and the baby drown or die of shock.

SUMMARY OF STUDY

From January 1, 1927 to January 1, 1937 during which time the greater part of this study was conducted, 17,860 live babies, from 7 to 9 months of gestation, were born in the Methodist Episcopal Hospital (Table II). Among them were many instances of respiratory depression and asphyxia ranging from mild morphinization to asphyxia pallida.

The 10 cases in Table I are examples of the latter class. In none were drugs administered to the mother less than 5 hours before delivery. In Case 4 no anesthetic was used. In the others gas oxygen with and without the addition of ether was employed. It is our custom to use a minimum amount of ether, therefore the anesthetic played a minor part as an etiological factor. Unless otherwise specified the "Simple Measures of Resuscitation" included suction, holding the baby head downward with the head extended, gentle flagellation, and sometimes pressure on the chest.

Delay in the employment of more modern methods in a few of the cases is explained by the reluctance of some obstetricians to utilize unfamiliar procedures when past experience has led them to believe older ones adequate. In Case 10 the armamentarium was not immediately available.

It is difficult, of course, to describe satisfactorily the relative severity of each case. Pallor, shock, and degree of tonus vary and can best be appreciated by those present. With the exception of Case 6 the cardiac pulsation is described. This is a useful index of the extent and duration of oxygen deprivation. The most accurate index of the gravity of a particular case is supplied by a blood analysis which was taken in all but Case 2. Other factors such as trauma, cerebral edema and hemorrhage cannot be estimated at the time of delivery. The oxygen content is normally about 12 volumes per cent, and it is remarkable that infants in Cases 3, 7, and 10 recovered. It is reasonable to assume that the low content persisted for only a short time, insufficient to damage permanently the delicate nerve cells of the center. On the other hand in Cases 7 and 10 the content must have sunk lower, for considerable time elapsed be

tween taking the blood and the first inspiration. Considering 7.40 to be a normal hydrogen-ion concentration, some of the readings fell to very low levels hardly compatible with recovery.

The blood was obtained under oil immediately after delivery before any resuscitative action was taken. The cord was doubly clamped and cut about 8 inches from the baby, and the blood was then removed from the placental section of the umbilical vein. In Cases 7 and 10 the cord was clamped and cut before delivery. Oxygen content was determined according to the method of Van Slyke and Neill. The serum hydrogen-ion concentration was measured electrometrically. In many cases including several in Table I, the total carbon dioxide content of the blood was determined as well as an estimation of the carbon dioxide tension. These figures are not given as we believe the oxygen content the factor of prime importance. We wish to avoid any discussion of the relative merits of pure oxygen and carbon dioxide-oxygen mixtures in primary resuscitation. A moving picture film was made of Cases 1 and 5 and this film, which includes the resuscitation of other cases, is available for those who are interested.

The question has been raised whether or not intravenous resuscitation should be practiced alone, if gas therapy or at least a tracheal tube are not available. This is optional when the prognosis appears favorable, even though the depression is deep and the respirations for the time being inadequate. Inasmuch as the graphs show that respiratory efficiency can be increased, and the thoracic cavity expanded by this method, it would seem that there is something to be gained and nothing to be lost by its use. The answer is decidedly in the affirmative if a prolonged apnea which has not responded to simple measures must be treated. This procedure will often initiate respiratory movements which, even if irregular, and comparatively few in number, result in air entering the alveoli. Although this fulfills only part of our recommendation, it is superior to crude, older methods.

Unless each stage of a technique has been previously experienced, success will not necessarily attend the first use of modern methods

in an urgent case. Adeptness at identifying, injecting, and stripping the umbilical vein is gained by injecting saline into normal infants. It has been observed that a primary failure will often severely prejudice one against later attempts, even when the technique was faulty.

We sincerely feel that a consideration of this study by those with open minds will result in the saving of many lives which would otherwise be lost.

CONCLUSIONS

1 The treatment of asphyxia neonatorum has not kept pace with other advances in obstetrics. Methods sometimes dangerous and of doubtful efficacy are widely employed. A thorough understanding of drugs, anesthetics and resuscitation should be part of the knowledge of the obstetrician.

2 Less than 5 volumes per cent of oxygen in umbilical vein blood is accompanied by clinical evidence of asphyxia. It is shown that a brief fall below 1 volume per cent is not necessarily fatal, but longer exposures cause permanent damage to the delicate nerve cells of the center and resuscitation is no longer possible.

3 New evidence is brought to light indicating that the atelectatic lung cannot be opened by gases under pressure in the trachea. Pressures as high as 18 millimeters of mercury fail to open alveoli and result in damage to the lung tissue. Lower, and therefore safer, pressures are even less efficacious.

4 Respiratory depressant drugs and anesthetics are discussed and listed in the order of their safety. Morphine alone or in combination, in the opinion of many, has other purposes during labor besides the relief of pain. Because of this, it need not be abandoned, as has been suggested by some writers, but should be expertly administered not less than 2 hours before delivery.

5 Methods of resuscitation both old and new are analyzed, and it is shown that no one method is entirely satisfactory.

6 A new method for obtaining graphs of the apnea and early respirations of the newborn is briefly described. The method furnishes conclusive evidence of respiratory status at birth, the effects of drugs and

anesthetics administered to the mother before delivery, upon the baby, and shows the efficacy of various methods of resuscitation

7 The results of animal and clinical studies of analeptics and respiratory stimulants are reported. Lobeline hydrochloride has given satisfactory results, particularly in regard to safety

8 It is shown that in cases of asphyxia pallida, the injection of a respiratory stimulant is logical and to a large extent the only possible way of producing a respiratory gasp

9 An improved technique for the administration of respiratory and cardiac stimulants, saline, etc., by means of the umbilical vein is described

10 We suggest and describe a technique which combines 3 methods for the treatment of serious cases. By this means important requisites are fulfilled and excellent results obtained

The authors extend their acknowledgment and thanks to Dr O P Humpstone director of the department of obstetrics and gynecology the Methodist Episcopal Hospital for the privilege of undertaking this study to Dr Ralph M Beach for numerous suggestions, and to Miss Mabel R Duryea R N for her invaluable co-operation

BIBLIOGRAPHY

- 1 BEHRENDT B and PULEWKA P *Klin Wchnschr*, 1936 37 1667
- 2 BLAILEY J B and GIBBERD G F *Lancet* 1935 1 3
- 3 BRICALFY *Pans letter* J Am M Ass 1935 104 1836
- 4 CORNISH R E Cited in Lazarus dead and alive *Time* 1934 23 49
- 5 CORILLOS I N and BIKBAUM G L *Arch Surg* 1929 19 1346-1423
- 6 CURTIS F R., and WEINERT, S *Lancet* 1926 Dec 18 1235
- 7 DE LEE J B *The Principles and Practice of Obstetrics* Philadelphia W B Saunders Co 1927
- 8 DOLLINGER K V *Gas u Wasserfach* 1926, 69 561

- 9 EASTMAN, N J *Bull Johns Hopkins Ho p*, 1932, 30 39-50
- 10 ECKSTEIN A *ROMINGER, E and WIELAND, H. Ztschr f Kinderheilk.* 1921, 28 218
- 11 EDMUNDS C W *Am. J Physiol* 1924 11 79
- 12 EVE, F C *Lancet* 1932, 2 995
- 13 EVE F C and KILLICK, E M *Lancet*, 1933 2 740
- 14 LAGG P J *J Am M Ass*, 1928 91 788 *Am. J Obst. & Gynec* 1931 21 537
- 15 HENDERSON, Y Personal communication.
- 16 HENDERSON, Y, HAGGARD H W, and COBURN R C *J Am. M Ass* 1920 74 783
- 17 HOLTSMANN N *Klin Wchnschr* 1925 4 2346
- 18 IRVING, F C, BERMAN, S, and NELSON H B *Surg Gynec & Obst* 1934 58 1-11
- 19 KING W J, HOSNER H R and DRESBACH M *J Pharmacol & Exper Therap*, 1928 32 241
- 20 KREISELMAN J KANE H F, and SWOPE R B *Am J Obst & Gynec*, 1928 15 552
- 21 LANG O *Ztschr f Gynaec*, 1926 23 1465
- 22 LEFF M *Am J Obst & Gynec*, 1931 24 898
- 23 MENNET J *Ztschr f Gynaec*, 1926 23 1522
- 24 MONCRIEFF ALAN *Lancet* 1935, 1 664-669
- 25 MURPHY, D P and BAUER, J T *Am J Dis. Child* 1933 45 1196-1202
- 26 MURPHY D P, and SESSUMS, J V *Surg Gynec & Obst* 1932 55 432-439
- 27 MURPHY D P, WILSON R B and BOWMAN J E *Am J Obst & Gynec* 1931 21 528-536
- 28 MUTO K. and IWAKAWA K *Arch f exper Path u Pharmacol* 1910 62 282
- 29 MORRIS, V H and WEISS S *J Pharmacol & Exper Therap* 1927 31 43
- 30 PIPER E B *The gas therapist*, 1934 1 15
- 31 SCHMIDT, CALL F *Am J Physiol* 1928 84 202
- 32 SCHOEY R and KAUBITSCH N *Deutsche Arch f klin Med* 1926 150 251
- 33 SCHUMACHER P *Ztschr f Geburtsh.* 1924 88 151
- 34 SCHWARTZ, A *Compt rend. soc de biol*, 1926 95 693
- 35 WALBAUM, H *Arch f exper Path u Pharmacol*, 1926 116 1
- 36 WIELAND H. *Arch f exper Path. u Pharmacol* 1915, 19 95
- 37 WIELAND, H., and BEHRENS, B *Ztschr f ges exper Med*, 1927, 56 454
- 38 WIELAND H., and MAIER R *Arch f exper Path u Pharmacol*, 1922, 92 195
- 39 WIELAND, H., SCHOEPP C and HERMSEN W *Ann. d Chem* 1925 444 40
- 40 WILSON, R A *Am J Obst & Gynec* 1928 16 379
- 41 WILSON R A and TORREY M A *Am J Surg* 1934, 23 426-437

PERITONEOSCOPY

JOHN C. RUDDOCK, M.D., F.A.C.P., Los Angeles, California

PERITONEOSCOPY is the procedure of visualizing the peritoneal cavity and its contents by means of an optical instrument. The first demonstration and application of this procedure was successfully carried out over 35 years ago and yet, strange to say, the method is but little used. In part, the reason for this reluctance to apply it is seen in the traditional wholesome conservatism with which every new scientific thought contends, and yet the endoscopic method of examining body cavities has hardly met with a clinical mishap which could serve as a hindrance to its acceptance.

Any procedure that allows one to see, through a mere puncture, the diseased organs clearly and sharply in the peritoneal cavity, without a laparotomy and without discomfort to the patient, is ideal. It is especially ideal when a biopsy from tumors or tissues may be obtained, after recognition of the pathology. The procedure of peritoneoscopy offers such an alternative. This method, however, will not and cannot replace a laparotomy, but it is the procedure of choice in a great many abdominal conditions. An acute abdominal case should not be considered, or selected for peritoneoscopy. Chronic cases only should be used, and hasty surgery should be censured when there is plenty of time to make a diagnosis on chronic abdominal conditions.

The internist must share the responsibility for fruitless laparotomies performed for diagnostic purposes, and should use all the ancillary procedures at his disposal before he recommends a diagnostic laparotomy, in order to make or corroborate an intra-abdominal diagnosis. Unfortunately, many of the diagnostic methods that are in use today for making intra-abdominal diagnoses allow only vague and presumptive conclusions. It is true that, by means of x-ray, a diagnosis may be made of intragastric lesions or lesions that

affect the continuity and contour of the gastrointestinal tract.

The roentgenologist can say whether a tumor is extragastric or intragastric, and in many cases, he can indicate the probability whether the lesion is malignant or not.

The gynecologist is able to palpate tumor masses in the pelvis, and, by correlation with clinical history and symptoms, he makes a presumptive diagnosis of the pathology encountered.

In cases of ascites, the internist, by correlation of the findings, and the examination of the fluid, will make a presumptive diagnosis of cirrhosis, malignancy, or tuberculosis, etc. Tumor masses are often encountered in the abdominal cavity, and the question arises as to whether these are cysts, abnormal lobes of the liver, retroperitoneal tumors, or malignancies. A diagnostic laparotomy, often referred to as a mere trifle, may be from the patient's point of view, a very formidable affair. It usually involves a general anesthetic followed, probably, by some flatulent discomfort, some anesthetic vomiting, 2 or 3 weeks' rest in bed, and occasionally complications with the wound. The expense may be considerable. In cases of carcinoma of the stomach or malignancy of the pancreas, death may follow so soon after as to raise a suspicion that the operation had something to do with the termination of the case.

Exploratory laparotomy	Peritoneoscopy
1. Economic features—large	1. Economic features—small
a. Major operation	a. Minor operation
b. No hospitalization—2 weeks	b. Hospitalization—1 day
c. Dressings—many	c. Dressings—few
2. General anesthetic	2. Local anesthetic
3. Diet limitations	3. No diet restrictions
4. Discomfort variable	4. Practically no discomfort
5. Large incision	5. 1/4 inch incision
6. Mortality risk—6 per cent (Lacey)	6. Mortality risk—0.2 per cent

Diagnostic laparotomy is often harmful by the accentuation of a neurosis and the ex-

From the Medical Department, University of Southern California Medical School, Los Angeles.
Chairman's address: General Medicine Section, California Medical Association, May 3, 1937, Del Monte, California.

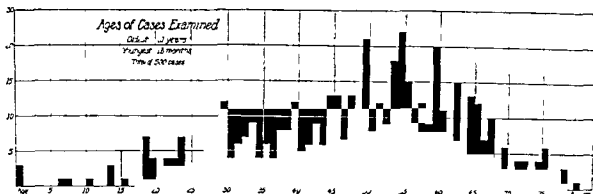


Chart 1 Diagram showing distribution as to age.

acerbation of symptoms, because of an undiscovered lesion or an inoperable lesion. A diagnostic laparotomy becomes fruitless in those cases in which intra abdominal malignancy of an inoperable nature is suspected and a laparotomy is done in the hope that the presumption is not correct. Pentoneoscopy is a far less formidable alternative.

The procedure of pentoneoscopy has been carried out for diagnostic purposes, on over 500 cases (Table I); the majority of the patients have been referred from the general diagnostic service of a large general hospital and others from private physicians. These patients have ranged in age from 18 months to 81 years, and have been both males and females (Chart 1). Many of the cases have been complicated with ascites so that a diagnosis has not been possible medically. Patients have been followed to the operating table whenever possible and at postmortem—while many patients are still living.

TABLE I.—ANALYSIS OF 500 CASES EXAMINED

Purpose of examination	Cases
Differential diagnosis	308
Corroborating diagnosis	118
Determination of metastases	58
Differentiation and localization of tumors	16
Total	500
Types of cases	
Males	213
Females	285
With ascites	229
With jaundice	100
Biopsy specimens from organs and tumors	39
Follow up	
Autopsies obtained	63
Subsequent operations	231

ANALYSIS OF 500 CASES EXAMINED

This series of 500 cases includes all cases examined or attempted in succession, over a period of 4 years, and cases are not selected. A successful method of obtaining biopsies was not accomplished until after 300 of these cases had been examined. Biopsies are taken only in selected cases. Chronic pelvic inflammatory diseases, ectopic pregnancies, or negative abdomens do not require biopsies. The determination that a tumor mass is an accessory lobe of the liver, a spleen, or a mass of rolled up omentum does not require a biopsy. Biopsies are taken when the abdominal pathology encountered is not obvious.

Biopsy material has been obtained from growths in the peritoneal cavity, when indicated for diagnosis. Biopsies have been taken repeatedly from the liver. All ascitic fluid obtained is given a careful examination. This is done by centrifuging, embedding the sediment in paraffin, sectioning and then examining and classifying the cytology present. Many cases of malignancy have been proven by this method. In addition, a bacteriological examination is made in every case.

The following pathological conditions have been noted, and diagnosed: general carcinomatosis of the peritoneal cavity, carcinomatous nodules in the liver (Fig. 1), carcinoma of the gall bladder, melanotic sarcoma of liver with metastases to the peritoneum, hemangioma of the liver, hydrops of the gall bladder, lymphoma of the stomach, carcinoma of the stomach, fibroid tumor of the uterus (Fig. 2), normal pregnancy, ectopic pregnancy (ruptured) ovarian cyst.

(Fig 3), ruptured chocolate cyst of the ovary, papillary cystadenoma of the ovary with metastases (Fig 4), hydrosalpinx, retroperitoneal myxosarcoma, retroperitoneal sarcoma, lipomyxosarcoma, cirrhosis of the liver, passive congestion of the liver, hepar lobatum, pancreatic cyst, carcinoma of the colon, intra-abdominal hemorrhage, intra-abdominal adhesions (Fig 5), tuberculous peritonitis, calcified lymph glands, retrocecal appendix, polycystic kidney

Patients with ascites offer the best type of case for this procedure because the abdominal wall, which has been stretched by the fluid, when withdrawn, allows the easy introduction of air. It is surprising how little discomfort is noted following the introduction of air into the peritoneal cavity, even in those cases in which there has been no previous distention. Ordinary atmospheric air is used instead of oxygen, nitrogen, or carbon dioxide. The amount of air introduced is not important as long as the patient is flat or in the Trendelenburg position. In my series there have been no complaints of the usual shoulder pains often described following a tubal insufflation. The air is always removed following the procedure, although some residual air, localized between the liver and diaphragm, often remains. This has been noted occasionally in cases examined with x-ray shortly following the procedure.

THE VALUE OF THIS METHOD

The value of peritoneoscopy lies in its ease of application and the differential diagnostic possibilities obtained through this direct, eye controlled method of examination. It is possible to diagnose a questionable case correctly and without delay. It is possible to decide early the advisability of operation in patients showing grave pathology. It is possible to differentiate tumor masses from various organs in the peritoneal cavity. It is a simple method for determining the operability of malignant gastric lesions.

Because of its ease of application, it is the method of choice, in preference to a diagnostic laparotomy for the differential diagnosis in cases of undetermined ascites, tuberculous peritonitis, the source of tumors, the operabil-

ity of intra-abdominal lesions, and the question of intra-abdominal metastases.

The indication for its use in gynecological cases needs no comment when the profession realizes the extent to which this ideal method of examination of the pelvic organs can be carried out. We are able to see the organs clearly in their natural living colors.

Peritoneoscopy does not, and will not, replace laparotomy, but it is the procedure to be selected when confronted with the above diagnostic problems.

I find several instances in my series where the clinical diagnosis appeared self-evident, but which was altered by peritoneoscopic examination. This has been true principally in cases in which the diagnosis has been changed from cirrhosis to malignancy or from malignancy to cirrhosis.

It is my opinion that all patients with clinical cirrhosis of the liver, or suspected cirrhosis, should have the benefit of a peritoneoscopy, in order definitely to classify the condition.

HISTORY OF THE SUBJECT

In 1901, Kelling (11, 12) first demonstrated this procedure on a living dog by inflating the abdominal cavity with air and examining the contents with a Nitze cystoscope. Kelling later published two monographs in the German literature, the first appearing in 1902 and the second, dealing with human subjects, in 1910. In 1910, Jacobaeus (3-9) of Stockholm published a paper on a like procedure of visceral exploration, developed independently by him.

In 1923, after 13 years of silence, Kelling (13) addressed the German surgical society concerning this subject. He related how the bad economic situation of the population after the war had compelled him to make wider use of this diagnostic method among his patients, since it saved them the prolonged and costly stay in the hospital which an exploratory laparotomy entails. The work of Kelling becomes remarkable in that the technique applied and described by him 35 years ago is, with little modification, the technique used today. He made use of pneumoperitoneum long before it was practiced in the field of



Fig 1

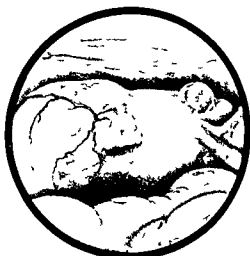


Fig 2



Fig 3



Fig 4



Fig 5

Fig 1 Carcinoma metastases in liver Note the metastatic implantation on under side of diaphragm View as obtained through peritoneoscope

Fig 2 Fibromyoma of uterus viewed through peritoneoscope

Fig 3 Ovarian cyst viewed through peritoneoscope

Fig 4 Papillary cystadenoma of ovary with peritoneal implantations viewed through peritoneoscope

Fig 5 Intra abdominal adhesions Note how adhesions between omentum and parietal peritoneum are stretched by the production of pneumoperitoneum Viewed through peritoneoscope

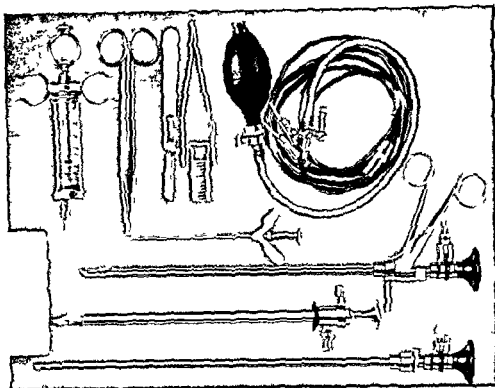


Fig. 6 Instruments necessary for procedure arranged with accessories: telescope, sheath with histoury tipped obturator, biopsy forceps with telescope, pneumoperitoneum needle, sphygmomanometer bulb and tubing, electric cord connection, scalpel, scissors, thumb forceps, syringe, sponges, and skin clamps.

roentgen diagnosis, but he failed to make early clinical application of his method and let Jacobaeus of Stockholm, almost 10 years later, receive recognition for the procedure. Kelling maintained that the mobility of the intestines in the living subject is such that they will not sustain injury, but will recede or slip aside before the gentle and slow thrust of the trocar. This same fact was brought out by Jacobaeus in his monographs on the procedure. Jacobaeus later devoted his major interests to the perfection of thoracoscopy and developed the technique of galvanocautery for separation of adhesion bands in the chest preliminary to collapse of the lung as used today throughout the world.

In 1911, Bernheim, an American, working at Johns Hopkins Medical School introduced a proctoscope of $\frac{1}{2}$ inch bore through an incision in the epigastrium and with the aid of a head mirror examined the stomach, liver, gall bladder, and diaphragm.

In 1912, Nordentoeft, of Copenhagen, devised an instrument which he termed a "trocar-endoscope" and patented under that name.

He described the first views of the interior of the female pelvis as seen when the patient was in Trendelenburg's position, after the abdomen had been distended with air.

In 1912, Tedesco, of Vienna, reported his experiences with laparoscopy, following the technique described by Jacobaeus.

In 1912 and 1919, Stolkind, in Russia, reported the use of this procedure.

In 1913, Merelles, in South America, published a discussion on laparoscopy.

In 1913 and 1915, Renon and Rosenthal, of Paris, considered this method excellent for making visible to the observer certain affections of the liver and peritoneum.

In 1914 and 1920, Rocavilla, of Italy, modified the method by designing an instrument which permitted the source of light to remain outside the abdomen.

In 1920, Orndoff, of Chicago, stated that he experimented with this method many years and was still practicing it. He particularly praised it in diagnoses of hemoperitoneum, tuberculous peritonitis, and extra-uterine pregnancy.

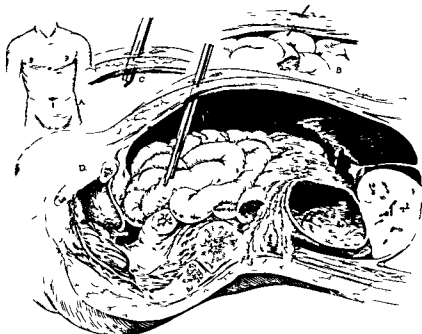


Fig. 1. Technique of peritoneoscopy. A Usual site of puncture. B insertion of pneumopertoneum needle. C insertion of trocar. D visualization of peritoneal contents with peritoneoscopy.

In 1924, papers appeared from Edwards, of London; Steiner of Atlanta; Georgia; Stone of Kansas; Zollikofer of Switzerland; and Unverricht of Germany.

In 1925, Nadeau and Kampmeier, of Chicago, published a very complete description of the technique of endoscopy of the abdomen.

The procedure has been given various names by the various workers who have pioneered in its development:

1. Coeloscopy (Kelling 1901)
2. Ventroscopy (Van Ott, 1901)
3. Laparoscopy (Jacobaeus 1911)
4. Organoscopy (Bernheim 1911)
5. Peritoneoscopy (Orndoff 1920)
6. Abdominoscopy (*Medical Dictionary*, and Steiner, 1924)
7. Celoscopy (*Medical Dictionary*)
8. Splanchnoscopy (*Medical Dictionary*)

The peritoneoscope (Fig. 6) developed for the examination of this series consists of five parts: (1) sheath, (2) bistoury-tipped obturator which fits the sheath, (3) telescope made to fit the sheath, and a biopsy forceps, (4) fluid evacuator, (5) small needle-trocar for

pneumopertoneum and a special Rchfuss tube with an electric light at the tip.

The sheath is of metal, lined with bakelite, the top of which is fitted with a lock and with a stopcock on the side. The sheath is arranged to receive snugly and lock in place the bistoury-tipped obturator, with dull point. When the obturator is in place the instrument becomes a trocar for making a puncture in the abdominal wall.

The telescope is one which gives the highest degree of light, the largest field, the smallest magnification, and the most direct vision. It is necessary that the telescope fit the sheath with an air-tight connection. It should be long enough to reach every part of the abdomen through one puncture below the umbilicus.

The biopsy forceps is a special rongeur-tipped forceps for securing specimens through the sheath. It fits the sheath air-tight. A special telescope allows visualization during the procedure of taking the biopsy. An electrical connection on the forceps allows the use of a coagulating current to control bleeding. The tip of the biopsy forceps becomes the coagulating electrode after specimen is taken.

The fluid evacuator is a straight tube closed at one end with multiple small perforations in its distal half. It is also equipped with an air tight lock that allows it to fit in the sheath. The open end is connected with a suction apparatus. The tube can be slipped in and out of the sheath which allows it to be pushed among the coils of bowels without injury.

Rubber tubing is necessary to connect either the fluid evacuator to a suction apparatus for withdrawing the fluid or to connect a bulb similar to that used on a blood pressure apparatus with the stopcock on the side of the sheath to inject air.

The pneumoperitoneum needle is a small, dull trocar needle apparatus 5 inches long. At the hilt of the needle there are two flanged handles so that it may be held steady during the inflation of air. The bulb with rubber tubing is arranged to fit this needle.

The stomach tube has an electric light on the tip and a perforation just proximal to the tip. Wires are threaded through the tube for the electrical connection. The electrical connection is similar to that used on the telescope, and is combined with an air connection which allows the stomach to be inflated with air at the time the light connection is made.

The procedure of peritoneoscopy has been done in all cases in the operating room. Strict aseptic technique has been used throughout the procedure.

The operating room technique is the same as for a laparotomy. The patient is draped and the abdomen prepared as for an abdominal incision. The peritoneoscopic instruments are sterilized by immersion in 1:1000 mercury cyanide solution for 30 minutes. This includes the electric cord for lighting purposes. Alcohol cannot be used as a sterilizing agent for the telescopes because it dissolves the cement around the lenses.

The equipment for an operating room set-up is as follows:

- 1 One 20 cubic centimeter Luer syringe with needles for anesthetization
- 2 30 cubic centimeters of 1 per cent novocain solution
- 3 One scalpel
- 4 One dozen small gauze sponges
- 5 One baumamometer bulb
- 6 One 8 inch or one 12 inch piece of rubber tubing to fit bulb and air connection of sheath
- 7 One battery for lighting instruments

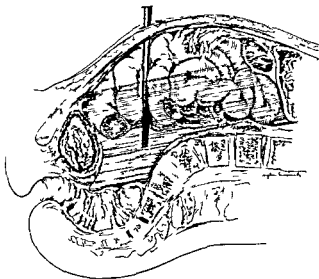


Fig. 8 Removing ascitic fluid with special fluid evacuator with patient in horizontal position

The operating room should be so arranged that it may be made dark during the examination.

TECHNIQUE

No preparation is necessary before the examination other than $\frac{1}{4}$ grain of morphine about 20 minutes before the puncture is to be made. The site of puncture is selected and local anesthesia with novocain is used. It is a good plan to encircle the puncture site with subcutaneous wheals of novocain with a diameter of approximately 10 centimeters. Following this, the needle is inserted to the peritoneum, and novocain is infiltrated just above it. A small stab incision is made just large enough to admit the sheath of the instrument snugly, and the point of the knife is carried down until the fascial layers are nicked. The pneumoperitoneum needle is inserted into the abdominal cavity gently and moved around in a circle to determine the presence of adhesions or fixed bowel at the point of entry. The abdomen is then distended with air and the pneumoperitoneum needle is removed. The sheath with the bistoury tipped obturator, which acts as a trocar, is now inserted into the abdominal cavity. When ascitic fluid is present, the insertion is exactly the same as the insertion of a trocar preparatory to an abdominal paracentesis. It is necessary in all cases that the abdominal wall be tense and fixed, either by distention of abdominal cavity with fluid or air, or both. The



Fig 9 Visualization of appendix (retrocecal) with patient on left side. Air displaces cecum so that appendix may be visualized.

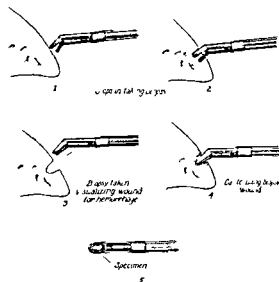


Fig 10 Technique of obtaining biopsy specimens through the peritoneoscope.

puncture must be carried out steadily and cautiously with the instrument pointing to either side of the spinal column, so that if the entrance into the cavity is made suddenly the gut will not be injured against the bony column.

As soon as the entrance has been accomplished the obturator is removed and the telescope is inserted. If fluid is present suction is applied with special evacuator inserted in the sheath and the abdomen emptied (Fig 8). This is done entirely with closed drainage. After evacuation of the cavity the air bulb is connected and the abdomen is distended with air. Ordinary atmospheric air is used. It is not necessary to measure the quantity of air used, as the abdominal cavity is not sensitive to inflation, and the patients do not complain of any other sensation except one of fullness.

As soon as the abdomen is distended, the peritoneal cavity and its contents become visible, and the examination may proceed. Upon completion of the examination the air is allowed to escape. One may assist the evacuation of air by pressure with the hand placed flat on the belly. Having evacuated the air, the instrument is removed. In cases of ascites the ascitic fluid may drain for a day or two. In cases without ascitic fluid one skin stitch or skin clamp is used and a simple

dressing is applied. No disability follows, and the patient is allowed to eat his meals without interruption.

VISUAL EXAMINATION

As the air is of light specific gravity, it remains uppermost in the abdominal cavity. Therefore, through changes of position of the patient, one is able to shift the air and thus displace the intestines at will. With the patient in a horizontal position, one has a full view of all organs in their normal relation under the abdominal wall. For an examination of the pelvis Trendelenburg's position is used. The organs in the left side of the abdomen come into view when the left side is uppermost, and likewise on the right (Fig 9). Therefore, a safe and easily changeable table is needed for the examination. Movements of the instruments cause the patient no discomfort unless pressure is made against the parietal peritoneum, or a loop of bowel is pulled by the tip. The light of the instrument shines through the abdominal wall, when the room is darkened, and shows where the tip of the instrument is located. With one hand on the abdominal surface, pressure and manipulation may assist considerably.

The whole examination should be done with a fixed plan in mind, otherwise the wonderful



Fig 11 Operability of gastric malignancy A, Visualizing stomach, liver, and adjacent tissues and localizing malignancy, B, unfolding stomach under vision with air, C, transillumination of inflated stomach

natural pictures would tend to lead astray and thus prevent seeing the important points. A general complete examination of the abdominal cavity, with recognition of organs and landmarks should be done before any diseased organs are examined. This is necessary in order that the examiner may become oriented and able to recognize the objects he sees. Pathological pictures may then be examined minutely. After a few examinations the pictures become very clear, natural, and easily understood. The instrument should be long enough so that a single puncture performed in the midline just below the umbilicus brings all the contents of the abdominal cavity into view. Puncture, however, may be made at any point in the abdomen.

Peritoneoscopy visualizes the surface of organs which are contained in the peritoneal cavity, but nothing inside of a viscus or buried deep in the tissues can be seen.

The liver, after air insufflation, falls away from the diaphragm and can be examined in regard to its color, smoothness, nodules and size. The edges can be followed, the upper surface, right and left lobes, and a portion of the under surface seen. The gall bladder can be noted beneath the edge. The thickness of the gall bladder, its color, circulation, and adhesions are easily seen. I have not been able to palpate the gall bladder with tip of the instrument for stones, as noted by Steiner.

The greater curvature of the stomach can be noted and the anterior surface examined

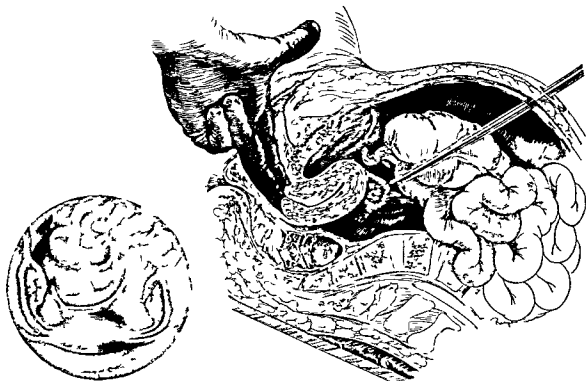


Fig. 12 Technique of pelvic examinations with view of pelvic organs obtained through peritoneoscope after

pneumoperitoneum is produced. The diagram shows manipulation of pelvic organs through the vagina.

The lower tip and edge of the spleen is seen in the extreme upper left quadrant just beyond the stomach surface. When enlarged the spleen is easily examined. The omentum can be examined completely. The surface of small coiled intestines gives a remarkable picture. Normally they appear with a slightly brownish hue, and peristaltic waves can be noted. The surface of the cecum, the ascending transverse and descending colons are easily visualized. The appendix is seen only occasionally.

The dome and posterior surface of the bladder, the fundus of the uterus tubes and ovaries are seen and the pathological state noted. The parietal pelvic peritoneum can be examined completely throughout.

TECHNIQUE OF OBTAINING BIOPSY SPECIMENS

Biopsy specimens may be obtained through the peritoneoscope sheath (Fig. 10). Biopsy specimens should not be taken directly from the tissues of a hollow viscus, abscesses, or

cysts encountered because of the possibility of injury or perforation. Liver and spleen biopsy specimens or suitable pieces of tissue from any solid organ or tumor mass can be obtained for examination. Biopsy specimens are easily obtained from metastases in the liver and omentum or from the peritoneal surfaces.

The tip of the biopsy forceps when closed is so arranged that it forms a cup containing the tissue material. The closed tip acts as an electrode for coagulating the wound resulting from cutting the biopsy specimen. The biopsy material is not affected by the coagulation current. All wounds should be thoroughly coagulated after the specimen is obtained, regardless of whether bleeding is noted or not. This is especially true when the specimens are taken from the liver or spleen.

The abdomen should be completely distended with air and the point selected for taking the material should be isolated from adjacent tissues, so that there is no possibility of coagulating other than the point from which

the tissue is taken Practically any type of high frequency generator, diathermy machine, coagulating unit or whatever else it may be called, can be used with the biopsy forceps for hemostasis or coagulation. The current may be properly adjusted before use, by trying it on a piece of meat.

A small visualizing telescope is used with the biopsy forceps so that the entire procedure of cutting the specimen and hemostasis is constantly under vision.

RECOGNITION OF PATHOLOGY

The macroscopic appearance of living tissues is quite distinctive and differs considerably from their appearance in the cadaver. Peristalsis is noted in intestines and stomach and pulsation is seen in liver and spleen.

When an examination is made of the contents of the abdominal cavity all the facts noted are correlated into a final conclusion. A large smooth, red liver would suggest chronic passive congestion or hepatitis, whereas a small liver with a wrinkled surface and hobnailed irregularities would suggest atrophic cirrhosis. Adhesions are noted as to whether they are situated at site of former operations, or are general. They may be spider web, lace-like, or massive bands. Carcinomatosis of the peritoneal cavity is seldom, if ever, associated with adhesions.

Absence of peristalsis in a localized area of the stomach suggests an intrinsic lesion in this portion. When the spleen is visible, it is enlarged. Dilated veins in the mesentery, stomach, and under surface of the diaphragm are seen in cases of cirrhosis. Malignant metastases usually are distinctive in that they are various sized nodules, but often milary implantations are impossible to differentiate from milary tuberculosis without a biopsy. A deeply jaundiced patient with a thickened, small whitish gall bladder would suggest chronic cholecystitis with stones, whereas a distended normal appearing gall bladder would suggest carcinoma of the head of the pancreas.

OPERABILITY OF GASTRIC MALIGNANCY

Early diagnosis is essential if there is any hope of reducing the mortality of stomach

cancer from its present high rate. By the time the patient presents a classic picture of gastric malignancy, weight loss, emaciation, and vomiting, not much hope is left, though the lesion be technically removable, operative mortality then looms too high. In Lahey, Swinton and Peelen's series, the x-ray pictures proved diagnostically accurate in 95 per cent of the cases. However, these men concluded that the decision as to the operability of a given stomach cancer is difficult and easily mistaken. They concluded that palliative operations were distinctly unfortunate in these cases, but that exploration to settle the question of operability was frequently indicated and that the mortality rate in those exploratory laparotomies was low. In the Lahey, Swinton and Peelen series, only 25 per cent of the cases were operable. In their series, explorations were done on 17.4 per cent of inoperable cases with a 6 per cent mortality from the exploration.

In cases of given stomach cancer, three things are necessary as to the decision of operability, provided that no metastases are demonstrable in the skin, glands, lungs, or bones. These are:

1. Are there metastases in the liver?
2. Is there extension to adjacent tissue and peritoneum?
3. How much of the stomach is not involved?

These questions can be answered in a very high percentage of cases by means of peritoneoscopy. Visible metastases can be seen and easily identified in the liver. The peritoneal surfaces and omentum can be examined for visible metastatic lesions. The malignancy in the stomach can be seen and adjacent tissues examined for extension of the lesion. By means of air and transillumination, the amount of uninvolved stomach wall can be approximately estimated.

Peritoneoscopy should always be done in lieu of exploration in order to determine the question of operability of a stomach cancer. In the Lahey, Swinton, and Peelen series in which 17.4 per cent had explorations and were found to be inoperable, the majority of these cases could have been determined by means of the simple procedure of peritoneoscopy.

The operative mortality of 6 per cent could have been markedly lessened

The technique (Fig 11) for the examination of a known case of gastric malignancy is not difficult. The patient is prepared as described for peritoneoscopy. The stomach is clean and empty. The special stomach tube, fitted with an electric light at its tip, is placed in the stomach through the mouth prior to examination. The peritoneoscope is inserted as previously described. The liver is visualized for metastatic lesions, the stomach is examined in its normal state, noting circulation, color, and pathology visible. The stomach is now distended with air under vision and examined while it unfolds. Good stomach wall distends, infiltrated stomach wall is rigid. When the stomach has been distended with air, the globe at the tip of the tube is lighted and the stomach wall is transilluminated. The stomach appears to the observer like a "Chinese lantern" and any infiltrations in the gastric mucosa can be outlined. It has been my custom to have the surgeon present at this examination in order to determine with the peritoneoscopist the operability of the case. In a small percentage of cases of this kind, no metastases are found except in retroperitoneal nodes. If such is the case, an exploratory laparotomy must be done, as peritoneoscopy will not visualize these retroperitoneal glands.

PELVIC EXAMINATIONS

The gynecologist becomes very adept in determining lesions in the female pelvis by manualy. However, he is often at a loss to determine the source and type of tumor masses, the presence or absence of ectopic pregnancies, the congenital absence of organs and to differentiate at times chronic pelvic inflammatory lesions from other pathology.

When a patient is placed in the Trendelenburg position and a pneumoperitoneum is produced (Fig 12), the viscera in the pelvis are displaced and the entire pelvis is exposed to view. The uterus, both tubes, both ovaries, and the sigmoid colon and bladder can be visualized. The examination is facilitated and assisted by inserting one hand in the vagina and manipulating the pelvic organs. The uterus may swing from side to side thus ex-

posing the tubes, ovaries, and round ligaments. Occasionally one may push up into view tumor masses buried deeply in the broad ligaments.

Ectopic pregnancies, malignancy of the ovaries, engorged reddened tortuous tubes, hydrops of the tubes, absence of organs, malformations of organs, adhesions, pelvic tuberculosis, malignant metastases, malignancies of the ovaries, cysts, and fibroids can all be seen and recognized.

OTHER EXAMINATIONS

The sigmoid colon can be examined with the peritoneoscope in the same manner as a stomach examination is conducted. A tube may be inserted into the rectum on the tip of which is an electric light. The colon is distended with air and transilluminated.

This procedure is also applicable to examining the colon for spasm and spasticity.

Diverticula may be noted, and in one case a diverticulum of a bladder was seen.

Hernias may be visualized from inside the abdominal cavity, and the tip of the telescope may even be placed in the hernial ring.

Abdominal examinations may be markedly assisted by manipulation of tumor masses and viscera with one hand of the operator on the abdominal wall.

COMPLICATIONS AND ACCIDENTS

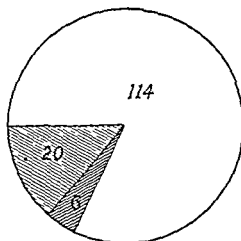
Puncture of a viscus is a complication that may happen to anyone attempting peritoneoscopy. This can be avoided, however, by (1) careful examination of the patient prior to attempting procedure, (2) selecting the point of puncture to avoid all operative abdominal scars, (3) always using a bistoury plunger with a dull tip.

Kelling (11, 12) maintained in his early writings on this subject that the mobility of the intestines in the living subject is such that they will not sustain injury but will recede or slip aside before the gentle and slow thrust of the trocar. This same fact has been brought out by Jacobaeus (3-9), Ruddock, and other writers on this subject. It is my opinion that any viscus, unless so adherent that all freedom of movement is gone, will slip aside before the thrust of the trocar in the living subject. The

TABLE II — ACCIDENTS AND COMPLICATIONS

Accidents	Cases	Per cent
1 Small bowel punctured with hypodermic needle, no sequelae	1	
2 Small bowel punctured with pneumoperitoneum needle Operation—hole repaired Uneventful recovery Cause—postoperative adhesions	1	
3 Small bowel punctured with trocar Operation—hole repaired Uneventful recovery Cause—postoperative adhesions	1	
4 Small bowel punctured with trocar Operation—hole repaired Uneventful recovery Cause—tuberculous peritonitis	1	
5 Transverse colon punctured with trocar Operation—hole repaired Uneventful recovery Cause—carcinomatosis	1	
6 Sigmoid colon punctured with trocar Operation—hole repaired Uneventful recovery Cause—intestinal obstruction (carcinoma of rectum)	1	
7 Stomach punctured with pneumoperitoneum needle Operation—hole repaired Uneventful recovery Cause—full meal	1	
8 Stomach punctured with trocar Operation—hole repaired Uneventful recovery Cause—dilated stomach (Hodgkin's disease)	1	
Total accidents	8	1.6
Deaths	1	2.7
Examination determined extensive metastatic carcinoma of liver. Biopsy specimen taken from nodule. Patient died 6 hours later of hemorrhage from biopsy wound in liver		
Summary		
Total cases examined	500	
Total complications and deaths	9	1.8
Unsuccessful examinations	3	0.6
Cause of failure to enter abdominal cavity in all 3 due to dense adhesions		

TABLE III — SUSPECTED CIRRHOSIS—140 CASES



	Cases	Per cent accuracy
Suspected clinically	140	
Actual cases proved	120	85.71
Pentoneoscopic diagnosis correct	114	95.00
Clinical errors — correctly diagnosed by pentoneoscopy —		
Malignancy	7	Per cent error
Normal	7	
Tuberculous peritonitis	2	
Hepatitis	2	
Cholecystitis	1	
Passive congestion	1	
Total clinical errors	20	14.29
Pentoneoscopic errors —		
Malignancy	2	
Normal	2	
Hepatitis	1	
Incomplete examination	1	
Total pentoneoscopic errors	6	5.00

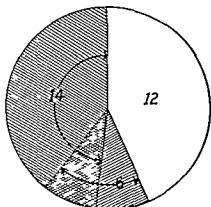
intestine may be punctured by this method, should it be firmly fixed to the parietal peritoneum by adhesions. Puncture of the bowel has occurred in my series of 500 cases 8 times (Table II). Each time the instrument has been left in place and an abdominal incision has been made. In each instance, the trocar could have been removed without soiling the peritoneal cavity, as the bowel was firmly plastered against the parietal peritoneum.

The death recorded, resulting from a fatal hemorrhage following a biopsy from a carcinoma metastatic nodule in the liver, occurred because of insufficient coagulation of the biopsy wound. Many biopsies have been taken since, but thorough coagulation of the wound is done, in all cases, whether bleeding is noted or not.

Due to extensive peritoneal malignancies and extensive adhesions from tuberculosis, cases will be encountered in which it is impossible to enter the abdominal cavity with a pentoneoscope. This has occurred three times in my series, once with malignancy and twice with tuberculosis. The pentoneoscope merely enters a small pocket walled off by adhesions, or it is impossible to produce a pneumoperitoneum in order to go ahead with the procedure. When such an abdomen is encountered, no attempt is made to insert the pentoneoscope. However, the finding of such a condition may accomplish the purpose for which the examination was intended.

Hernia through the scar of the puncture wound has not occurred in my series of cases. Hematoma at the site of the puncture wound has occurred on two occasions.

TABLE IV —SUSPECTED TUBERCULOUS PERITONITIS—32 CASES



	Cases	Per cent accuracy
Suspected clinically	32	
Actual cases proved	18	56.25
Pentoneoscopic diagnosis correct	12	66.67

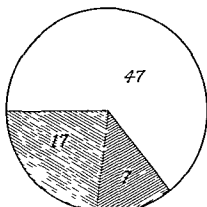
	Cases	Per cent error
Clinical errors—correctly diagnosed by pentoneoscopy—		
Cirrhosis of the liver	4	
Carcinoma of the peritoneum	4	
Pelvic inflammatory disease	3	
Pelvic malignancy	1	
Postoperative adhesions	1	
Unsuspected	1	
Total clinical errors	14	43.75
Pentoneoscopic errors—		
Carcinoma of the peritoneum	1	
Pelvic malignancy	2	
Normal abdomen	1	
Unsuccessful	1	
Accident	1	
Total pentoneoscopic errors	6	33.33
Both in error	3	

ACCOMPLISHMENT OF PURPOSE OF EXAMINATION

The procedure of pentoneoscopy should not be done without a definite purpose for which the examination is made. The procedure is then carried out in order to accomplish this purpose. To determine the presence of metastases to corroborate a diagnosis, to differentiate and localize tumor masses, and to aid in differential diagnoses, are purposes of examination which justify the procedure.

If the purpose of examination is accomplished, then the examination is successful and justified. The procedure should not be expected to accomplish more than the purpose for which it is done.

TABLE V —SUSPECTED PERITONEAL METASTASES—71 CASES



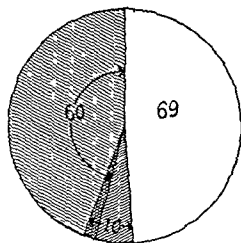
	Cases	Per cent accuracy
Suspected clinically	71	
Actual cases proved	54	61.1
Pentoneoscopic diagnosis correct	41	81.93

	Cases	Per cent error
Clinical errors—correctly diagnosed by pentoneoscopy—		
Tuberculous peritonitis	3	
Cirrhosis of the liver	4	
Postoperative adhesions	2	
Intestinal obstruction	2	
No metastases	2	
Ovarian cyst	1	
Unsuspected	3	
Total clinical errors	17	23.9
Pentoneoscopic errors—		
No metastases	3	
Lues	1	
Tuberculous peritonitis	1	
Unsuccessful	1	
Accident	1	
Total pentoneoscopic errors	7	12.97

PERITONEOSCOPIC STATISTICAL STUDY OF DIAGNOSTIC ACCURACY

The compilation of statistics with regard to comparing accurately clinical methods of diagnoses and pentoneoscopic methods becomes exceedingly difficult. This is especially true when a case is referred for pentoneoscopy with four or five suspected clinical diagnoses. One may be correct, the others may be wrong, or all may be wrong and the pentoneoscopic diagnosis may be right or wrong. The accompanying tables reveal the percentage of clinical accuracy compared to the percentage of pentoneoscopic accuracy and list the errors in diagnosis for both methods. Selected for statistical study are suspected cases of tuber-

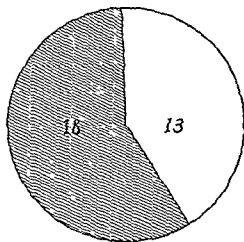
TABLE VI—SUSPECTED MALIGNANCY OF THE LIVER—135 CASES



Suspected clinically	135	Per cent accuracy
Actual cases proved	79	55.6
Pentoneoscopic diagnosis correct	69	87.4

Clinical errors—correctly diagnosed by pentoneoscopy—		
Cirrhosis	34	Per cent error
Hepatitis	3	
Passive congestion	2	
Normal	0	
Chronic cholecystitis	2	
Postoperative adhesions	2	
Unsuspected	4	
Ovarian cyst	1	
Carcinoma of the ovary	1	
Abscess	1	
Hepar lobatum	1	
Total clinical errors	60	44.4
Pentoneoscopic errors—		
Cirrhosis	6	
Normal	2	
Abscess	1	
Passive congestion	1	
Total pentoneoscopic errors	10	12.6
Both in error	2	

TABLE VII—SUSPECTED ECTOPIC PREGNANCIES—31 CASES



Suspected clinically	31	Per cent accuracy
Actual cases proved	13	42
Pentoneoscopic diagnosis correct	13	100

Clinical errors—correctly diagnosed by pentoneoscopy—		
Intra uterine pregnancies	10	Per cent error
Intra uterine pregnancies with pelvic inflammatory disease	4	
Pelvic inflammatory disease	3	
Ruptured ovarian cyst	1	
Total clinical errors	18	58
Total pentoneoscopic errors	0	0

pentoneoscopic accuracy is 91.7 per cent. The comparison for the individual case diagnosis is shown in the Tables III to VII.

Twenty-two cases of this series of ectopic pregnancies have been reported by Dr. Robert B. Hope in the February, 1937, issue of SURGERY, GYNECOLOGY AND OBSTETRICS. Dr. Hope has acted as my assistant during the past 3 years in the clinical examination of patients by pentoneoscopic methods.

SUMMARY

Pentoneoscopy should be selected in lieu of a diagnostic laparotomy where it is necessary to determine malignancies, metastases and extent of involvement, to differentiate tumor masses, and localize them, to examine the surfaces of viscera and pelvic organs or to corroborate a diagnosis or to obtain biopsies. It should not be selected for use in cases with inflammatory lesions in the peritoneal cavity.

Pentoneoscopy is a minor procedure under local anesthesia, with practically no discomfort.

culous peritonitis, peritoneal metastases, cirrhosis, malignancies of the liver (both primary and secondary), and ectopic pregnancies. This makes a total of 499 cases.

This is the number of cases conforming to the above diagnoses which have occurred in the series of 500 cases reported. The remaining 111 cases are made up of various diagnoses, a series of each of which is too small for making a statistical study.

The average clinical accuracy in the total series is 63.9 per cent, whereas the average

fort and small economic features, in contrast to a diagnostic laparotomy which is a major procedure requiring a general anesthetic, and entailing considerable economic features and variable discomfort

The procedure cannot take the place of surgery, but, by making a definite and correct diagnosis, it may prove a valuable aid, if the case is an operable one and surgery is deemed necessary

The value of this procedure becomes evident when we note that examinations may be made completely and accurately, biopsy specimens of tumor masses and tissues may be quickly, safely, and painlessly taken for diagnostic purposes, and exploration of poor surgical risks may be accomplished

All patients with a diagnosis of cirrhosis, or suspected cirrhosis, of the liver, should be examined with the peritoneoscope for corroboration. A questionable diagnosis can often be excluded or confirmed, and a decision reached as to form, kind, and extent of the pathological process

A definite purpose of examination is necessary to justify a peritoneoscopic examination. The procedure should not be expected to accomplish more than the purpose for which it is done

The very practical results of this relatively simple method of examining the contents of the abdominal cavity with the eye should command for it, as a diagnostic procedure, the general use which the cystoscope now holds for the examination of the bladder and kidneys

The peritoneoscopic accuracy, as noted in a statistical study of 409 case studies, is 91.7 per cent as compared to the clinical accuracy of 63.9 per cent

The procedure of peritoneoscopy is a technical one and requires that the operator train himself in the details of the procedure and in the use of the instruments. He should be able to recognize and differentiate the macroscopic appearance of pathological processes when seen

Appreciation is expressed to Drs. Robert B. Hope of Los Angeles, California, and Andrew B. Bonthuis of Pasadena, California, for the assistance which they rendered in making the clinical examination of the patients included in this series

REFERENCES

1. BERNHEIM BERTRAM M. Organoscopy, cystoscopy of the abdominal cavity. *Ann. Surg.* 1911 52 764-76.
2. HOPE, ROBERT B. The differential diagnosis of ectopic gestation by peritoneoscopy. *Surg. Gynec. & Obst.*, 1937, 64 229-234.
- ✓ 3. JACOBÆUS, H. C. Ueber die Möglichkeit die Zystoskopie bei Untersuchung seröser Höhlungen anzuwenden. *München. med. Wchnschr.* 1910 58 2090-2092.
4. Idem. Kurze Übersichts ueber meine Erfahrungen mit der Laparothoraskopie. *München. med. Wchnschr.* 1911 57 2017-2019.
5. Idem. Ueber Laparo und Thoraskopie. *Beitr. z. Klin. d. Tuberk.* 1912, 25 183-354.
6. Idem. Laparo-ochthoraskopie. *Hygæa, Stockholm* 1912 74 1070-1091.
7. Idem. Sur la laparoscopie et la thoracoscopie. *J. méd. franç.* 1913 7 10, 0-1091.
8. Idem. The use of laparo thoracoscopy from a practical point of view. *Tr. Internat. Cong. Med.* 1913 London, 1914 Sect. 6 Medicine pt 2 p 565-599.
9. Idem. Können durch die Laparoskopie Indikationen zur chirurgischen Eingriffen gewonnen werden. *Nord. med. Arch.* 1914 14 1-6.
10. JOHNSON A. Bidrag till Kannedomen om laparo-och thoraskopie. *Finska Lak. säll. handl.* Helsingfors, 1916 58 719-743.
- ✓ 11. KELLING GEORGE. Ueber Oesophagoskopie, Gastroskopie und Koelioskopie. Read before the 73rd Versamml. Deutsch. Naturforscher und Aerzte. Hamburg September 23 1901. *München. med. Wchnschr.* 1902 (Jan. 7) 21.
12. Idem. Reply to Jacobæus. Ueber die Möglichkeit die Zystoskopie bei Untersuchung seröser Höhlungen anzuwenden. *München. med. Wchnschr.* 1910 57 2358.
13. Idem. Zur Coelioskopie und Gastroskopie. *Arch. f. klin. Chir.* 1923 136 226-238.
- ✓ 14. KORSCH R. Die Laparoskopie nach Jacobæus. *Berl. klin. Wchnschr.* 1921 58 696-698.
15. Idem. Technik und Grenzen der Laparoskopie. *München. med. Wchnschr.* 1922 69 426.
16. LAHEY F. H. SWINTON N. W. and PEELEY M. Cancer of the stomach: an analysis of 105 cases with end results. *New England J. Med.* 1935 212 863-868.
- ✓ 17. METRELLES E. A. Laparoscopia. *Tribuna med., Rio de Jan.* 1913 199.
18. NADEAU and KAMPMEIER. Endoscopy of abdomen. *Surg. Gynec. & Obst.* 1925 41 259-271.
19. NADEAU OSCAR. Differential diagnosis of carcinoma and tuberculous peritonitis by means of the cystoscope. *Surg. Clin. N. America*, 1918 (June) pp 561-565.
- ✓ 20. ORSDOFF B. Ueber Endoskopie geschlossener Cavitäten mittelst meines Trokart Endoskops. *Verhandl. d. deutsch. Gesellsch. f. Chir.* Berl. 1912 1 78-81.
21. Idem. Ueber Endoskopie geschlossener Höhlen. *Deutsche med. Wchnschr.* 1918 39 1840.
- ✓ 22. ORSDOFF B. H. The peritoneoscope in diagnosis of diseases of the abdomen. *J. Radiol.* 1920 1 397-325. *Nebraska M. J.*, 1920 5 124-126.
23. Idem. Peritoneoscopy pneumoperitoneum and x rays in abdominal diagnosis. *Illinois M. J.* 1927, 39 64-62.
- ✓ 24. OTT I. IMITRI (EDLER VON OTT). Illumination of the abdomen (Ventrosocopia) (In Russian). *J. Akush. i Zhen.k. Bolez.* S. Peterb., 1901 15 1045-1049.

- 25 Idem Die direkte Beleuchtung der Bauchhöhle, der Harnblase des Dickdarms und des Uterus zu diagnostischen Zwecken Rev de méd tchèque, Prague, 1909, 2 27-29
- ✓ 26 RENON, L. Technique et indications de la laparoscopie Rev gén de clin et de thérap, 1913, 27 148-150, Presse méd, 1913, 700
- ✓ 27 ROCCAVILLA, A. L'endoscopia delle grandi cavità sierose mediante un nuovo apparecchio ad illuminazione diretta Riforma med, Napoli, 1914, 30 991-995
- 28 Idem. Laparoscopia e pneumoradiologie abdominale Radiol med, 1920, 7 411-420
- 29 ROSENTHAL, G. Le laparothoracope de Jacobaeus Bull gén de thérap 1913, 165 802-804
- 30 RUDDOCK, JOHN C. Peritoneoscopy Western J Surg, 1934, 42 392
- ✓ 31 SCHMIDT, ADOLF Laparoskopie und Thorakoskopie nach Jacobaeus Muenchen med. Wchnschr, 1914, 61 1882
- 32 SHORT A RENDLE The uses of coeloscopy Brit M J, (August 8) 1925, p 254
- ✓ 33 STEINER, O P Abdominoscopy Surg, Gynec & Obst, 1914, 38 266-269
- 34 STOLLING, E J The value of pleuroscopy (thoracoscopy) in the diagnosis of pulmonary diseases, and laparoscopy in the diagnosis of abdominal diseases Med Press, London, 1919, 107 46-48
- ✓ 35 STONE, W E Intra abdominal examination by aid of the peritoneoscope J Kansas M Soc, 1924, 24 63-66
- ✓ 36 SWEET, W O A new and practical abdominoscope Surg, Gynec & Obst, 1927, 45 700-701
- 37 TEDESKO, F Ueber Endoskopie des abdomens und des Thorax Mitt d Gesellsch f inn Med u Kinderh in Wien, 1912, 12 323-327
- 38 THOM, BRUNO Ectoscopy in diseases of the abdomen Muenchen med Wchnschr, 1932, 79 1909
- 39 TIERNEY, J L Pneumoperitoneum J Missouri State M Ass, 1920, 17 137-145
- ✓ 40 UNVERRICHT Die Thorakoskopie und Laparoskopie Berl klin Wchnschr, 1923, 2 502
- ✓ 41 ZOLLIKOFER, R Ueber Laparoskopie Schweiz med Wchnschr, 1924, 104 264-265

HEMORRHAGIC OR TRAUMATIC CYSTS OF MANDIBLE

ROBERT H IVY, M D, F A C S, and LAWRENCE CURTIS M D, F A C S,

Philadelphia, Pennsylvania

THE great majority of cysts of the jaw bones originate in abnormal development of cells derived from the enamel organ of the tooth, and have a capsule lined with epithelium. However, one is occasionally surprised to find a case, especially in the mandible, in which a cavity exists in the bone, containing fluid, but in which no lining membrane apparently is present. It is well known that non epithelial cysts occur in the long bones of the extremities in connection with osteitis fibrosa, and also following trauma, which latter have been explained on the basis of hematoma formation. According to Blum, to whom we are greatly indebted for information in preparing this paper, Boettcher and Beneke were the first to conceive of a traumatic hematocyst developing in a previously healthy bone. Their findings were confirmed by von Haberer and Pommer, who described the mechanism and the pathology. Briefly, the process is one of intramedullary hemorrhage from trauma insufficient to cause fracture, in a young bone. To quote Thoma: "The intra osseous blood clot causes pressure on the vessels, producing stasis. The decomposing fibrin, in turn, causes an irritation, which results in resorption of the bony trabeculae of the spongiosa. This produces a large cavity in the central part of the bone. The cyst increases in size by displacement of the spongiosa." Hemorrhagic cysts, comparable to cysts found in the long bones as a result of trauma, have been reported in the mandible. All cases described have been in adolescents, most of them have been apparently due to intramedullary hemorrhage following trauma insufficient to cause fracture or escape of blood into the surrounding soft tissues. Probably the first mention of such a condition was made by Lucas in 1929, he described x ray and

operative findings which are in conformity with the reports of later writers. Other cases have been mentioned by Schneider, Thoma, and Blum. Blum was the first in this country to describe the pathology of these lesions, showing their correspondence in every respect with the hemorrhagic cysts of the long bones.

The cavity in the bone is apparently unconnected with the teeth, although the roots of the latter may be secondarily involved. It is filled with decomposed blood and later with clear serous fluid, and at operation clinical examination shows no lining membrane, the walls of the cavity being apparently bare. In Blum's cases, however, histological examination of the bony wall showed that a thin lining was present, consisting of blood vessels embedded in a loose framework of connective tissue fibers and a compressed layer of dissolved red corpuscles. Osteoblastic and osteoclastic changes in the bony walls were also seen.

The diagnosis may be difficult. It depends on a history of trauma—sometimes quite vague, in a young patient, insufficient to cause fracture, with later development of dull pain, and sometimes a swelling of the body of the mandible, x ray findings of a well defined, somewhat irregular cavity in the bone along the course of the inferior dental canal, with no apparent connection with the roots of the teeth, the pulps of the latter being vital. Differentiation from dental root cysts and dentigerous cysts may be practically impossible before operation, unless the x ray shows definite connection of the roots of a pulpless tooth or of the crown of an unerupted tooth with cyst cavity. At operation the absence of a definite epithelial membrane characteristic of the cysts of dental origin is at once evident.

Benign giant cell tumor offers another difficulty, but usually shows x ray evidence of bony trabeculae running through the tumor.

From the Department of Maxillofacial Surgery, Graduate School of Medicine, University of Pennsylvania and the Presbyterian Hospital, Read before the Philadelphia Academy of Surgery April 5 1937.



Fig 1 left Case 1 Roentgenogram before operation, showing clearly defined cavity in mandible not involving the roots of the teeth

Fig 2 Case 1 Roentgenogram made 3 years after operation showing obliteration of cyst cavity by new bone



Fig 3 left Case 2 Roentgenogram before operation

Fig 4 Case 2 Roentgenogram made about a year after operation showing bone regeneration

mass. The rapid development after trauma often leads to fear of sarcoma. If necessary, the cystic character of the swelling can be demonstrated before operation by aspiration.

Treatment consists in opening into the bone cavity after exposure through a flap of gum or through skin incision, and evacuating the fluid contents. The cavity is preferably kept open and allowed to heal by granulation.

Blum states that these cysts would probably respond favorably to aspiration of their fluid contents, but rightly favors wide opening and evacuation, as in this way only the presence or absence of an epithelial membrane can be determined. Also, if cyst wall bulges, aspiration alone might not cause collapse and restore the normal contour of the bone.

To the cases previously reported by Lucas (1 case), Schneider (3 cases), Blum (3 cases) and Thoma (2 cases), we wish to add 4 of our own. It is to be noted that 3 of our cases were

in sons of physicians, though of course this is merely a coincidence.

CASE 1. H. S., aged 10 years, male, was referred by Dr. L. P. Pendergrass in February, 1931, on account of a swelling of the left side of the mandible. This had been noticed for about 6 months and seemed to be slowly increasing in size but gave only slight discomfort. There was a vague history of a blow received on the jaw 2 years before. There was no history of trouble with the teeth on that side of the lower jaw and examination showed the premolar and first molar teeth normally erupted, and pulps vital. Beneath these teeth there was an oval swelling the result of thinning and expansion of the outer cortical plate and lower border of the bone, which yielded easily to pressure on the skin. X-ray examination (Fig. 1) revealed a clearly defined cavity in the bone beneath the incompletely calcified roots of the premolar and molar teeth, the latter, however, not being exposed in the bone cavity. The lower border of the bone was exceedingly thin and bulged convexly downward. General physical examination, blood chemistry, etc., were normal.

At operation at the Graduate Hospital, February



Fig 5



Fig 6



Fig 8



Fig 7

Fig 5 Case 3 Anteroposterior x ray view showing cystic cavity in left side of mandible

Fig 6 Case 3 Lateral view of mandible before operation

Fig 7 Case 3 Dental x ray films showing details of cyst formation in region of roots of teeth

Fig 8 Case 3 Roentgenogram made 1 year after operation showing bone regeneration

13 1931 under general anesthesia because we desired not to injure the attachment of apparently normal teeth a skin incision was made over the convex lower border of the swelling and a portion of the paper like lower bony wall was removed. A quantity of clear straw colored fluid was immediately discharged after which it was possible to examine the interior of the cavity. This had apparently bare bony walls with no lining membrane as is present in cysts of dental origin. The tooth roots were seen to be covered by a thin layer of bone. The cavity was lightly packed with gauze which was replaced several times until healing occurred. Subsequent x ray studies (Fig 2) showed a gradual filling in of the cavity with new bone.

CASE 2 R P male, aged 19 years was first seen by us on March 15 1935. Almost 3 weeks previously, while playing basketball he received a hard blow from an opponent's shoulder on the left side of the

lower jaw. He did not recall any previous injury to the jaw. After the injury he had pain and some swelling of the left side of the jaw with slight elongation and tenderness of the molar teeth. No fracture of the jaw was found. A few days after the injury the first molar tooth was removed in an effort to relieve the pain but the latter continued. On examination very little swelling of the left side of the mandible was evident, but the bone was tender and the second molar was quite sore to the touch. The pulps of the remaining teeth were vital. X ray examination by Dr W C Westcott (Fig 3) showed a large cavity with fairly well defined margins in the left side of the mandible extending from beneath the premolars to the third molar region. The third molar was unerupted with uncalcified roots, but did not have any connection with the bone cavity, thus eliminating the diagnosis of a dentigerous cyst. The roots of the other teeth were apparently not involved in the bone cavity. March 28, 1935 5



Fig 9 Case 4. Roentgenogram of right side of mandible showing cyst cavity before operation

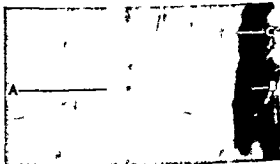


Fig 10 Photomicrograph of section of bony wall of cyst removed at operation. A Compacta B hemorrhagic coagulum C osteolytic absorption lacunae (Dr H R Churchill)

weeks after the injury, at Presbyterian Hospital, under general anesthesia an incision was made in the gum on the outer side of the teeth in the left lower jaw. Some of the very thick outer plate of the mandible was removed, thus exposing a cavity in the bone extending below the molar and premolar teeth. This cavity was apparently filled with old blood, and no lining membrane was present, it evidently represented an early stage of hemorrhagic cyst formation. A small gauze pack was inserted in the opening. Packing was discontinued after a few days and the wound in the mouth was allowed to close. This case has been characterized by persistent pain, somewhat relieved by later removal of the second molar tooth, but even at the present time there is a dull ache in the jaw. Later x ray examinations have revealed a progressive filling in of the cavity with new bone, until at the present time the outlines of the cavity are barely discernible (Fig 4).

CASE 3. R W H, male, aged 20 years, first consulted us on February 10, 1936, the condition of the lower jaw having been discovered about a month previously during a routine x ray examination of the teeth. No pain or other symptoms was complained of, patient could recall no definite injury to the jaw. Careful palpation revealed a slight thickening of the body of the mandible on the left side. The teeth showed no abnormalities except a large filling in the first molar. The pulps of the teeth were vital.

X ray examination showed a large, well defined cavity in the left side of the mandible, extending from the canine to the third molar, apparently not involving the roots of the teeth (Figs 5 and 6). Dental films showed definite bony plates covering the roots, isolating them from the cavity (Fig 7).

February 13, 1936, at Presbyterian Hospital, under general anesthesia, a skin incision was made beneath the lower border of the mandible. The very thin external plate was removed and a large bone cavity exposed, containing clear fluid and no lining. The inferior dental nerve and vessels, and the finer nerves and vessels going to the roots of the teeth, were seen. A rubber dam drain was inserted and the incision partly closed. The drain was left out after 10 days. Pathological examination of the bony wall showed nothing of special interest, except disintegrated blood debris on its inner surface. X ray examination a year later revealed practically complete regeneration of bone (Fig 8).

CASE 4. H H, female, aged 13 years, was first seen on October 6, 1936. Six months before, she had received a blow on the lower jaw to the right of the symphysis. The overlying tissues at the time became swollen and discolored, but no fracture of the mandible was found and no special treatment was given. The acute swelling gradually became less, but some enlargement to the right of the chin persisted. For the past few weeks she had complained of considerable pain in the right side of the lower jaw, probably due to a carious molar tooth.

The patient was a well nourished girl, with no complaints or abnormalities except in the region of

the lower jaw. The contour of the lower part of the right side of the face was seen to be more prominent than that of the left side. Examination inside the mouth revealed a smooth, non tender bulging of the lingual and buccal plates of the right side of the mandible, extending from the first molar to the canine tooth. The overlying mucous membrane was normal. There were no abnormalities of the teeth except a carious cavity in the first molar. X ray examination showed a clear cut cavity in the right side of the mandible extending from first molar to canine region, not involving roots of teeth (Fig 9).

October 15, 1936, at Presbyterian Hospital, under ether anesthesia, an incision was made in the gum over the outer aspect of the right side of the mandible from the first molar to the canine, beneath the roots of these teeth, and the soft tissue flap was reflected downward. The thin outer bony plate was easily removed, exposing a large irregular cavity in the bone, filled with clear, straw colored fluid. No soft tissue was present in the cavity. The roots of the teeth were covered with a thin plate of bone and the vessels and nerves could be seen running to their apices from the main trunks. Nothing more was done beyond lightly packing the cavity with gauze. The packing was discontinued after a few days and the wound gradually healed. Examination of a portion of the thin bony wall showed normal compact bone with a hemorrhagic coagulum and some evidence of osteolysis on its inner surface (Fig 10).

SUMMARY

Attention is called to certain cystic conditions of the mandible, due to trauma insufficient to produce fracture, but causing intramedullary hemorrhage with disintegration of cancellated bone and cavity formation. These are comparable in every way to traumatic cysts of the long bones, having no epithelial lining characteristic of cysts of dental origin.

Since the preparation of this paper we have encountered a fifth case in a girl of 16 years, involving the right side of the mandible, similar in every respect to those reported in detail, and operated upon on May 14, 1937.

BIBLIOGRAPHY

1. BECKE, R. *Ostitis fibrosa und Knochenzysten*. Verh. d. deutsch. pathol. Gesellsch., 1904, pt. 1, 240.
2. BLUM, T. J. *Am. D. Ass.*, 1932, 19, 281.
3. BOETTCHER. *Ueber Knochenzysten im Humerus*. Zentrbl. f. Chir., 1904, 27, 157 (suppl.).
4. HABEREK, H. *von*. *Zur Frage der Knochenzysten*. Arch. f. klin. Chir., 1910, 93, 791.
5. LUCAS, C. D. *J. Am. D. Ass.*, 1929, 16, 647.
6. POMMER, G. *Zur Kenntniss der progressiven Haematom und Phlegmasieveränderungen der Roehrenknochen auf Grund mikroskopischer Befunde in neuen Knochenzystenfälle*. Arch. f. Orthop., 1920, 17, 17.
7. SCHNEIDER, O. *Ztschr. f. Stomatol.* 1931, 28, 80.
8. THOMA, K. H. *Clinical Pathology of the Jaws*, p. 255. Springfield, Ill. C. C. Thomas, 1934.

PITUITARY BASOPHILISM

A Review of 42 Verified Cases, With a Report of a Personal Case

P BROOKE BLAND, M D, F A C S, and LEOPOLD GOLDSTEIN, M D,
Philadelphia, Pennsylvania

DURING the past 5 years increasing interest and attention have been drawn to an endocrinopathy, more commonly affecting women, in which the adrenal glands seemingly play a prominent rôle. The syndrome referred to is characterized chiefly by hirsutism, obesity, especially of the face, abdomen, and trunk, osteoporosis, cutaneous striæ, and hyperglycemia.

Since 1756, when William Cooke (quoted by Oppenheimer) described a case manifesting this syndrome, numerous cases have been described in the literature under various designations. As examples Alfred Gallais in 1912 described the syndrome and termed it "le syndrome genito surrenal," and Krabbe in 1921 outlined the syndrome which he designated "adrenal hirsutism."

In 1921 Achard and Thiers likewise discussed an endocrine condition which they named "diabetes of bearded women" and which was characterized by hypertrichosis of the face, obesity, hypertension and amenorrhea. At autopsy hyperplasia of the adrenal glands was usually noted in these patients.

The causation of this syndrome until 1932 was generally considered to be an overactivity of the suprarenal glands, induced either by simple hyperplasia of the glandular structure or by functionally active adenomas or other types of neoplasms.

Recently, patients manifesting this syndrome have been observed who recovered completely following the removal of portions of hyperplastic adrenal glands or the enucleation of adrenal adenomas. Walters and associates, in 1934, recorded 2 cases in which the successful removal of suprarenal tumors brought about disappearance of all symptoms

and return of the physical appearance of the patients to normal.

On the other hand, there are recorded reports of bilateral exploratory operations on the adrenal glands in patients with this syndrome in whom no gross evidence of suprarenal tumor, hypertrophy or hyperplasia could be found. Two cases of this type were reported by Walters and his co-workers in which biopsy of specimens removed during operation from each adrenal gland exhibited no evidence of hyperplasia on microscopical examination. Subsequent autopsy examination of the pituitary gland from one of these patients, who died 1 year later, disclosed an adenoma of the anterior lobe, 5 millimeters in diameter, composed of basophilic cells.

In another patient recently described by Crile and his associates, a girl, aged 17 years, who manifested the chief symptoms and signs of Cushing's syndrome, improved remarkably following bilateral denervation of the adrenals and a partial adrenalectomy of one gland. However, when the patient died 18 months later from acute myocarditis, autopsy revealed a chromophobe adenoma of the pituitary with possibly scattered basophilic cells. The adrenal glands showed a reduction of cortical tissue and fibrosis.

The aforementioned and other similar cases recorded in the literature suggest the thought that the adrenal glands are not the only organs concerned in the production of this syndrome.

In 1932, Harvey Cushing (13) collected 14 cases, in which the clinical picture was similar to that manifested by patients with tumor or hyperplasia of the adrenal cortex. Ten patients were found to have basophilic adenomas of the pituitary body and the remainder had tumors which could not be definitely classified. Frequently the adrenal cortex was found to be hypertrophied.

With respect to the presence of a basophilic adenoma in the pituitary gland in cases of the syndrome, Cushing (13-17) in his treatise on the subject states

Some of these syndromes have unquestionably been due to cortico adrenal tumors and in not a few instances, indeed, such a tumor has been removed at operation with definite amelioration of symptoms. What is more, in similar states, suprarenal tumors have been found after death in the absence of any recognizable abnormality in the pituitary body, though all too often the protocol refers to the examination of this structure, either in the briefest terms or not at all. While there is every reason to concede, therefore, that a disorder of somewhat similar aspect may occur in association with pineal, with gonadal or with adrenal tumors, the fact that the peculiar polyglandular syndrome, which pains have been taken herein conservatively to describe, may accompany a basophil adenoma in the absence of any apparent alteration in the adrenal cortex other than a possible secondary hyperplasia, will give pathologists reason in the future more carefully to scrutinize the anterior pituitary for lesions of similar compositions.

Two examples of adenomas of the anterior pituitary composed of basophilic elements were first described by Erdheim in 1903. In one, a basophilic adenoma 15 millimeters in diameter, was found in a woman 40 years old, who showed symptoms of Basedow's disease. In the other, a tiny basophilic adenoma in association with an eosinophilic adenoma was discovered in the pituitary gland. This dual neoplasm occurred in an acromegalic patient 43 years of age.

Since the early report of Erdheim, a number of investigators have recorded the finding of basophilic adenomas of the hypophysis during postmortem study in patients dying from various diseases. Among these may be mentioned Simmonds, Christeller, Naegeli and Susman.

Microscopic study of hypophyses removed during routine necropsy examination of persons meeting accidental death or dying from causes, apparently of non-pituitary origin, have disclosed a rather high incidence of adenomas of the pituitary gland. A study of serial sections of the pituitary bodies of 127 patients, none of whom had presented Cushing's syndrome, by Brauchli in 1927, disclosed an incidence of 21 or 31 per cent adenomas, including 3 of the basophile type. R. T. Cos-

tello likewise made a similar study of 1000 pituitaries removed during routine autopsy examinations and found 40 basophilic adenomas, an incidence of 4 per cent. These studies were later confirmed by Susman, who found an incidence of 22 adenomas among 260 pituitaries, 8, or 31 per cent, being composed of basophilic elements, and he, therefore, concluded that this incidence of basophilic adenoma is too great to be of any special significance.

In this study we have made an exhaustive search of the literature, and collected so far as possible all recorded cases manifesting the well known symptoms of this syndrome in which autopsy or operation revealed the presence of an adenoma of the anterior pituitary gland. We have thus far succeeded in collecting 42 cases which have been tabulated in Table I.

Cases which clinically belong to this group but in which the patients are alive or in which autopsy has not been performed have not been included in this analysis, but will be considered in a subsequent report.

Since the spring of 1934 we have had under observation a patient who manifested many of the symptoms of pituitary basophilism and who received pituitary irradiation.

CASE REPORT

The patient, aged 20 years (Figs 1 and 2), an unmarried female, was first seen on April 10, 1934. Her chief complaint was swelling of the face and feet, irregular menstrual periods, growth of hair on the face associated with an extensive acne-like skin eruption. She had in September, 1933, been observed in the Vanderbilt Clinic, New York City, where a diagnosis of pluriglandular syndrome was made.

Her menstrual cycle which began at the age of 13 years was regular for 5 years and then became irregular. The periods recurred about every 3 or 4 months and lasted 2 or 3 days. Her last period, before coming under observation, occurred in February, 1934. She began to gain weight about a year previously, and it increased from 120 to 132 pounds. She suffered deep mental anguish because of the skin eruption and the hirsuties on her face. She also became psychically depressed and physically inactive.

Other prominent symptoms were extreme dryness of the skin, falling of the hair on the scalp, puffiness of the eyes, frequent urination, polydipsia, and marked redness of the face. Occasionally she complained of pain in the arms and legs, and swelling of the ankles.



Fig 1 a Photograph of patient with pituitary basophilism taken in 1932 prior to onset of symptoms b Photograph taken in 1935 The acneiform eruption is visible but the hairy growth has been decolorized by the patient c Photograph taken March 3 1937 following deep pituitary irradiation Note the loss of adipose tissue in the face and chest, the improvement in color of the skin and disappearance of the acne

On physical examination the most striking feature was the obesity of the face and upper part of the trunk and back.

The face assumed a round or moonlike appearance. The skin was tense and of a vivid hue. There was an abnormal growth of hair especially visible on the sides of the forehead upper lip and chin. There was an acneiform eruption of the face extending over the upper portion of chest both anteriorly and posteriorly. The breasts were of normal development but showed several striæ. A fine hirsutism was present over the lower abdomen. The distribution of the pubic hair tended toward the masculine type.

Rectal examination disclosed the uterus to be of normal size and in an anterior position.

The systolic blood pressure was 130 millimeters and the diastolic 80 millimeters. At no time did the systolic pressure exceed 135 millimeters. The blood count showed 4 600 000 erythrocytes 7 000 leucocytes and 87 per cent hemoglobin. The differential white cell count was normal. The Wassermann blood reaction was negative. The basal metabolism test performed on April 12 1934 was plus 9 per cent. The cranial roentgenogram made by Dr John T. Farrell Jr. showed a sella turcica definitely enlarged, and a thinning out of the posterior clinoids. A blood sugar study (arterial blood) showed the following:

	mgms
First determination (fasting)	118
One half hour after glucose	190
One and one half hours after glucose	250
Two and one half hours after glucose	250

(One hundred grams of glucose given by mouth with 200 cubic centimeters of water)

The patient was referred to the dermatological department for local treatment of the skin eruption since the appearance of the face was causing her mental depression bordering on a psychosis.

When the patient first came under observation a diagnosis of pituitary deficiency was tentatively made. Accordingly, she was referred to Dr. Farrell for irradiation of the pituitary gland with factors of treatment as follows:

934	Filter mm. alu- minum	Milli- amperes	Spark	Time in	Dos- ta- tion	Area
May 15	4	5	0	2	12	Right skull
May 15	4	5	0	2	12	Left skull
May 22	4	5	0	2	12	Right skull
May 22	4	5	0	2	12	Left skull

Roentgenograms taken of the spine, pelvis, and extremities disclosed no evidence of decalcification.

The blood cholesterol was 188 milligrams, the blood calcium was 11.2 milligrams, and the blood phosphorus was 2.8 milligrams. Ophthalmological studies showed slight contraction of the visual fields. Retinal examinations were negative.

During the course of study, the patient had a menstrual period in May. Extraction of 60 cubic centimeters of urine did not show the presence of prolactin.

The patient's psychical state improved considerably concurrently with improvement in the dermatological condition. She became much brighter mentally and obtained a position as a stenographer. There was, however, little or no improvement in the swelling of the face or ankles or in the hirsutism.

Because of the failure of general improvement following low dosage irradiation given in May, 1934 and the persistence of the edema of the ankles

swelling of the face, persistent hirsutism, mental depression, polyuria, polydipsia, etc., pituitary basophilism was strongly suspected. She was then referred to the roentgenologist for a series of deep irradiation of the pituitary gland, and received the following course of treatment

1934	Filter		Mili amperes	Spark kv	Time min	Dis- tance cm	Area
	Cop- per	Alu- minum					
June 12	✓	1	8	200	8	50	Right skull
June 12		1	8	200	8	50	Left skull
June 20	✓	1	8	200	4	50	Right skull
June 20		1	8	200	4	50	Left skull

Two months following this recourse there was noticed considerable general improvement. The redness and swelling of the face had decreased, the swelling of the ankles had disappeared entirely. The patient was mentally normal and became very active. The facial hirsuties did not improve, and the patient had not menstruated since May, 1934. However the improvement did not continue, and in January, 1935, the only permanent change noted was the disappearance of the swelling of the ankles.

An intravenous pyelographic study was then made to determine, if possible, the presence of an adrenal neoplasm. This study was entirely negative. Extraction of a 24 hour specimen of urine also failed to disclose a determinable amount of estrin.

These two studies negated the presence of an adrenal neoplasm. She was again referred for pituitary irradiation and received 100 per cent skin erythema dose or 650 r to each side of the skull between January 27, 1935, and February 28, 1935.

The factors in the roentgen treatment were as follows

135 kv, 5 ma, 40 cm, and 6 mm Al filter

Shortly following this administration, she was examined by Dr Harvey Cushing, who concurred in the diagnosis of pituitary basophilism and recommended another course of pituitary irradiation which was given by Dr Farrell as follows

1935	Mili amperes	Kilo- volts	Cop- per	Alu- minum	Dis- tance cm	Time min	r units	Pitu- itary
April 24	8	200	✓	1	50	13	300	Right
April 6	8	200	✓	1	50	13	300	Left
April 9	8	200	✓	1	50	13	300	Right
May 1	8	200	✓	1	50	13	300	Left

Two months following this series of treatments there was decided improvement in the endocrine symptoms. Hirsutism appeared to be diminished, polyuria was reduced, and the patient had a general feeling of well being.

In September, 1935, she received another course of pituitary irradiation, consisting of 300 r units to each side of the head on alternate days for four ses-

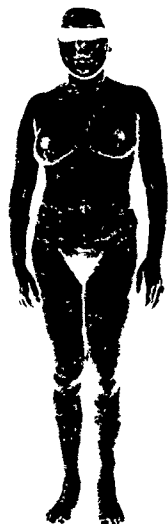


Fig 2 Author's case of pituitary basophilism responding to deep roentgen therapy of the pituitary gland. Note the "moon shaped" appearance of the face and striae on breasts

sions. No further improvement was noticed in the appearance of the face after this course of irradiation.

The basal metabolic rate was minus 7 per cent, and she was given $\frac{1}{2}$ grain of thyroid extract three times daily. Another roentgen examination of the wrists, lower portion of the radius, ulnae, lower portion of the femora and tibiae presented no evidence of decalcification or bony pathological changes.

From March 31, 1936, to April 16, 1936, she was given another course of deep pituitary irradiation to the left and right pituitary region on six occasions under the supervision of Dr B P Widman. She received 300 r units to the right and left temporal area at each treatment with the following factors

200 kv, $\frac{1}{2}$ mm Cu, 10 by 10 cm field, for a total of twice 1800 r units.

TABLE I—VERIFIED CASES OF IUTITARY BASOPHILISM

Case	A. th. r. year	Chief symptoms					Other symptoms	Pathological findings			Treatment	Cause of death
		Age %	Obesity	Amn. Hirsutism	Abdominal dist.	Glycosuria	Neutrophilic leukocytosis	Leucopenia	Leucopenia	Thyroid		
1	Schneid. Molnau 1913	48 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Colloid hyperthyroidism		
2	Anderson 1915	26 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Anemia
3	Reichmann 1919	35 f	Face	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Death after operation peritonitis
4	Cushing (Miss L.) 1921	45 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Pituitary adenoma
5	Zondek 1923	22 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Erysipelas
6	Rasch Kraus 1924	31 M	Yes	Impotence	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Sepsis
7	Parsons Weber 1926	28 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Pulmonary edema
8	J. Bauer 1930	35 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Erysipelas post-operative
9	Wuth-Pedersen 1931	24 M	Yes	Impotence	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Pulmonary edema
10	Teel 1931	20 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Menstruation
11	Cushing (Miss J.) 1932	33 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Pulmonary edema
12	Mohl 1932	41 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Cardiac failure postoperative
13	Bl. h. p. (Miss J.) 1932	22 f	Yes	Yes	Yes	Yes	Yes	Yes	Leucopenia	Simple goiter		Pulmonary edema
14	Bl. bl. ger 1933	27 f	No	Yes	Yes	No	Yes	No	Leucopenia	Simple goiter		Death after operation
15	S. I. 1933	27 f	Yes	Yes	Yes	No	Yes	No	Leucopenia	Simple goiter		Death after operation

TABLE 1—VERIFIED CASES OF PITUITARY BASOPHILISM—Continued

TABLE 1—VERIFIED CASES OF PITUITARY BASOPHILISM—Continued

Case	Author Year	Chief symptoms						Other symptoms	Pathological findings			Treatment	Cause of death	
		Age Sex	Obesity	Amenorrhea	Hirsutism	Abdominal striae	Glycosuria	Skeletal decalcification	Hypertension	Pituitary	Adrenals	Other glands		
16	Rutishauser 1933	41 F	Yes	Yes	Yes	Yes		Yes	Yes	Basophilic adenoma	Hypertrophy	Fatty parathyroids	Medical	
17	Rutishauser 1933	29 F	Yes	Yes	Yes	Yes				Increase in basophilic cells	Not men- tioned	Fatty parathyroids Atrophic gonads	Thyroid	Not mentioned
18	Rutishauser 1933	69 F	Yes	Post- menopausal				Yes	Yes	Basophilic adenoma	Not men- tioned	Fatty parathyroids Lactone's curriosa Colloid goiter		
19	Marburg 1933	26 M	Yes	Dis- min- ished potency	Yes	Yes	Yes	Yes		Basophilic adenoma	Not men- tioned			
20	Craig and Cran 1934	28 F	Yes	Yes	Yes	Yes	No	Yes	Yes	Basophilic adenoma	Hypertrophy		Pituitary irradiation	Broncho- pneumonia
21	Russell Evans and Crooke 1934	2 M	Yes	Impo- tence	No	Yes		No		Basophilic adenoma	Not men- tioned			Nephritis
22	Russell, Evans and Crooke 1934	2 F	Yes	No	Yes	Yes			Yes	Basophilic adenoma	Hypertrophy			Nephritis
23	Josephson and Berg strand 1934	42 F	Yes	Hypo- men- orrhea	Yes		Yes			Basophilic adenoma	Hypertrophy	Cystic ovaries	Exploratory operation	
24	Raab 1934	44 F	Yes	Yes	Yes		No	Yes	No	Basophilic adenoma	Normal	Colloid goiter		
25	Greppi and Redaelli 1934	2 F	Yes	Menopausal	Yes				Yes	Basophilic hyperplasia	Hyperplasia	Atrophic ovaries		
26	Walters Walker and Kemper 1934	34 F	Yes	Yes	Yes	Yes		Yes	Yes	Basophilic adenoma	Normal		X-ray to pitu- itary and thyroid par- thyrals adrenalectomy	Pneumonia, 3 months after operation
27	Klein 1935	13 F	Yes	Yes	Yes			Yes		Basophilic adenoma	Hyperplasia			
28	Jonas 1935	37 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Basophilic adenoma	Not men- tioned	Adenoma of para- thyroid Atrophic ovaries		

TABLE 1—VIRILIFIED CASES OF PITUITARY BASOPHILISM—Continued

Case	Author Year	Chief symptoms						Pathological findings				Treatment	Cause of death		
		Age Sex	Ob- scur- ity	Amor- phous os- seous	Hypor- thymia	Abnor- mal sugar	Glyco- suria	Skel- etal clac- ca	Hyper- ten- sion	Other symptoms	Pituitary			Adrenals	Other glands
29	Minerotti 1915	35 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Headache cardiac failure pains in legs	Basophilic adenoma	Normal	Hyperplastic thy- roid and para- thyroids Atrophic ovaries		Cardiac failure
30	Waldenström 1915	38 M	Yes	Loss of libido		Yes	Yes	Yes	Yes	Dyspnea polydipsia edema of feet lum- bago polyuria	Basophilic adenoma	Small adenoma of cortex	Atrophic testicles Atrophic thyroid	Pituitary irradiation	
31	Hörroek 1915	53 M	Yes	Loss of libido	Fem- inine type	Yes	No	Yes	No	Dyspnea pains debility	Small adenoma (testoniphilic)		Atrophic testicles	Medical	Cardiac failure Tuberculous pleurisy
32	Hörs 1915	38 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Pains in extremities	Basophilic adenoma	Hyperplasia and small adenoma	Enlarged parathy- roids Atrophic ovaries	X ray	
33	Gouldy 1915	37 F	Yes		Yes	Yes	Yes	Yes	Yes	Dyspnea headache	Basophilic adenoma		Sclerotic ovaries	Medical	Cerebral apoplexy
34	MacCallum et al 1915	35 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Dyspnea polyuria	Basophilic adenoma	Enlarged (normal)		Operation	Died after prelosteroscopy
35	Lieser 1915	28 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Atypical chro- mophilic adenoma	Patient living			Recovery after operation
36	Lescher 1915	32 F	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Microscopic basophilic adenoma	Carcinoma of adrenals			Died after adrenalectomy
37	Wright 1915	31 M	Yes		Yes	Yes	Yes			Convulsions head- ache abdominal pains	Basophilic adenoma	Hyperplasia and adenoma	Normal para- thyroids	X ray	Died after splenectomy
38	Swan and Stephenson 1915	20 F	Yes	Yes	Yes			Yes	Yes	Renal colic	Basophilic adenoma	Hypertrophy		Medical	Renal colic
39	Lawrence and Zim- merman 1916	44 M	Yes		Yes			Yes	Yes	Leukemoid pup- erated reaction of aorta lymphoma coronary occlusion	Basophilic adenoma				
40	Fowler 1916	20 M	Yes	Loss of libido		Yes	No	No	Yes	Mentally depressed polyuria	Chromophilic adenoma	Normal		Operation on adrenals X ray to pituitary	Isospermatism
41	Freyberg 1916	10 M	Yes	Loss of libido		Yes		Yes	Yes	Polyuria polydipsia	Basophilic adenoma	Normal	Ovaries atrophic fatty parathy- roids	X ray to pituitary	Pulmonary edema Pneumonia septicemia
42	Chida 1916	17 F	Yes	Con- genital os- seous dys- crasia	Yes	Yes	Yes	No	Yes	Fatigue nervousness headache polyuria thromb	Chromophilic adenoma with vacu- oles	X ducton of adrenal tissue		Adrenal ducton excision	Acute pyelitis (155 p. par- athyroid adeno- ectomy)

From June 2, 1936, to June 30, 1936, she received 5 treatments with the same factors, but with a field of 4 by 5 centimeters for a total of 2 times 750 r units to the right and left temporal region and direct to the pituitary region. At this time roentgenography showed the sella turcica to be normal, and there was no roentgen evidence of rarefaction in the bones of the right arm or right leg.

No immediate results were noticed after this course of deep irradiation. There was a loss of hair at the site of irradiation. The blood calcium study showed 9.6 milligrams per 100 cubic centimeters. Roentgenogram of the sella turcica disclosed it to be within normal range.

In October, 1936, the patient again consulted Dr. Harvey Cushing at the New Haven Hospital. While under his observation, roentgenographic study of the adrenal glands was made with negative results. Since then, there has been a steady and progressive improvement in the hirsutism and obesity. The patient has lost 13 pounds in weight and on January 26, 1937, weighed 122 pounds. The cyanotic color and acne of the face have completely disappeared. The swelling of the face has been reduced remarkably. There has also been a decided improvement in the posture, the tendency to kyphosis having disappeared. A period occurred in October, 1936, but not since. Probably the improvement was the result of the last course of deep irradiation of the pituitary gland.

This patient exhibited the prominent features emphasized by Cushing as being manifestations of basophilic adenoma of the pituitary body. These are in the order of their importance: (1) plethoric obesity of the face, (2) hirsutism, (3) amenorrhea, (4) cutaneous striae, and (5) metabolic disturbances.

Obesity. The obesity with swelling of the face was the most conspicuous feature in our patient. The change that occurred in the appearance of the face may be observed in comparing the photographs in Figure 1. Obesity of the face and trunk, with tendency toward kyphosis, was present in the entire group of cases recorded in Table I, with one exception.

Hirsutism. This symptom was noted in 29 of the female patients. It is often the chief complaint of patients suffering with this endocrinopathy. The abnormal growth of hair occurs on the sides of the face, upper lip, and on the chin. There is usually a growth of hair on the lower portion of the abdomen assuming masculine type of distribution.

Amenorrhea. Amenorrhea was the most constant menstrual disturbance noted, this finding being present in 23 cases. Four patients

were either menopausal or postmenopausal or had been castrated by previous operation, whereas, in only 1 patient was amenorrhea noted as being absent. (Loss of libido or sexual impotence was a constant finding in the male, 8 patients.)

Skeletal decalcification. Although skeletal decalcification has been observed in the majority of reported verified cases, at no time did our patient exhibit any clinical signs or roentgen findings suggesting osteoporosis. This may possibly be attributed to the early institution of deep irradiation of the pituitary gland. Skeletal decalcification was detected by roentgenography or found at autopsy in 27 cases, or 80 per cent of the 33 cases, recorded in Table I, in which this finding was mentioned.

Age. The ages of the patients, at the time of the reports, ranged from 11 years to 65 years.

Sex. This syndrome is overwhelmingly more commonly encountered and recognized in the female.

In the cases herewith recorded, there were 32 in females and 10 in males.

Other symptoms. Hypertension was noted in 25 cases or 86 per cent of the 29 cases where this symptom was recorded. Abdominal striae were observed and recorded in 27 cases. Among other prominent symptoms noted may be mentioned asthenia, headache, dyspnea, psychosis, emotional disturbances, polydipsia, polyphagia, ecchymoses, pains in the extremities, tachycardia, and convulsions.

Laboratory findings. The basal metabolic rate seemingly had no pronounced alteration in the reported cases, being low in some and high in others. No marked changes in the calcium content of the blood are accompaniments of basophilism. A number of the patients showed high values of blood calcium, while the calcium level was within normal limits in others. Polycythemia has been noted in several of the reported cases.

OUTCOME

Pulmonary complications and symptoms referable to the cardiovascular system were a common feature in the cases described. For example, the termination in 8 or 24 per cent

of the 30 patients in whom the cause of death was recorded, was by pulmonary edema or cardiac failure

That patients with pituitary basophilism cannot withstand operative measures and are poor risks for any type of surgical procedure is shown by the fact that 9 patients succumbed after operation of one type or another. Five patients were operated upon for suspected adrenal neoplasm, and they all died following partial or total adrenalectomy (Freyberg, Lescher, Fuller, Reichmann, and Bauer). It is of absorbing interest to note that in only one of these patients was an adrenal neoplasm found at operation. Later at autopsy a minute basophilic adenoma was discovered in the pituitary gland (Lescher). One patient, described by Moehlig, died following thyroidectomy. Of 2 patients operated upon for the removal of pituitary tumor, one succumbed, while the other made a good recovery with cessation of the symptoms (Lisser). One patient, who had improved somewhat as a result of pituitary irradiation, died subsequently after an appendectomy (Wright). One case terminated fatally from infection following direct pyelocystoscopy.

Patients with this peculiar endocrinopathy are, in addition to being poor surgical risks, also liable to various types of general as well as dermatological infections, 2 patients died of erysipelas and 1 from sepsis as a result of a severe skin infection.

DIAGNOSIS

Since, in numerous cases reported in the literature, similar clinical phenomena may be found associated with or due to neoplasm of the adrenal cortex, the diagnosis of pituitary basophilism must rest on the exclusion of adrenal cortical tumor or hypertrophy. There is an increasing number of cases in which operative removal of adrenal cortical neoplasms has resulted in complete recovery with disappearance of the distressing symptoms. However, cases are recorded in which exploratory operations have resulted in death of the patients without the disclosure of any trace of either adrenal hypertrophy or neoplasm.

To avoid accidents of this nature it is extremely important to direct all efforts of therapy toward the pituitary gland before

entertaining any operative procedure on the adrenal glands.

Since basophilic adenomas of the pituitary body are so small that bony alterations are not, as a rule, produced, roentgenography of the sella turcica is of no aid in the diagnosis of the condition. Likewise, contraction of the visual fields has only occasionally been observed in cases of pituitary basophilism. There was only slight contraction of the visual fields, taken repeatedly, in the patient here with reported.

A recent perfection in the technique of roentgenography has become an important adjunct in the diagnosis of tumors and hypertrophy of the adrenal gland. The x ray is of special value in cases in which no palpable mass is present. Recently, a method has been developed of visualizing the suprarenal gland by the injection of a measured amount of air directly into the perirenal space by hand pressure (Cahill). This worker found that the injected air would more or less slowly infiltrate through the fascial planes so that exposures 12 to 36 hours later would show the organ and fascial planes clearly, especially around the adrenal gland. This method has been found of value in demonstrating both the pathological as well as the normal adrenal gland.

PATHOLOGY

Forty-one of the 42 patients studied in this survey were examined post mortem, and microscopic examination was made of the hypophyses. A chromophobe adenoma was removed successfully by operation in the case reported by Lisser. A specific diagnosis of basophilic adenoma was made in 35 cases, while only an "increase in basophilic cells" was reported in 1 case.

Two of the neoplasms were described as "eosinophilic" adenomas, and in 1 case reported by Cushing (13), the tumor was noted as a "large invasive adenoma."

In the case reported by Wieth Pedersen (38), an adenoma composed of non granular elements was found at autopsy, while chromophobe adenomas were disclosed in the cases reported by Fuller and Crile.

Postmortem study of the suprarenal glands was completed and recorded by 29 authors in

29 cases Hyperplasia or hypertrophy of the adrenal cortex alone or with definite adenomatous formation was a strikingly frequent occurrence Varying degrees of hyperplasia or hypertrophy were encountered in the removed adrenal glands of 18 patients, or 63 per cent of the 29 cases, and in addition to hypertrophy, a definite adenoma of the cortex was found in 4 cases (Anderson, Wright, Hildebrand, and Hora)

The adrenal glands were noted as entirely normal in only 8 instances, or an incidence of 26 per cent

Carcinoma of the adrenal gland was found in 1 case (35), while hypoplasia of the suprarenal cortex was present in Freyberg's case

The high incidence of secondary hyperplastic changes in the adrenal glands in pituitary basophilism may, according to Cushing (17), bear the same causative relationship to basophilic adenomas of the pituitary as do the frequently associated adenomas of the adrenal cortex to acidophilic adenomas of acromegaly

Atrophy or atresia of the ovaries was a common finding, being reported in 16 cases

A fatty condition of the parathyroids was also a fairly common necropsy finding

In Schmorl's case, there was observed hyperplasia of the parathyroids without adenomatous formation

In several cases there was found an enlargement of the thyroid or a colloid goiter

In many of the cases reported, the thymus gland was atrophic, in some it was replaced by fat, and in a few it was normal in size In the cases reported by Teel and Freyberg, the thymus glands were hyperplastic and definitely enlarged The role played by the thymus in this syndrome is probably not important, although several cases are on record in which neoplasms of the thymus were associated with a clinical syndrome identical with basophilia (Leyton, 36, Kepler)

With respect to the pathology of Cushing's disease, Crooke (25) states "that the only factor common to the syndrome, regardless of whether the pituitary or adrenal gland be the site of tumor formation, is a hyaline change in the basophilic cells of the anterior hypophysis which apparently is not an expression of altered physiological activity"

In association with the chromophobe adenoma of the pituitary gland reported by Fuller there was noted hyaline change in the cytoplasm of the basophile cells

In 3 cases of Cushing's syndrome reported by Rasmussen, in which no pituitary adenoma was found, but in one of which a carcinoma of the adrenal gland was present, the pituitary sections showed extensive hyaline changes in the basophiles of the anterior lobe and in some of the basophiles of the posterior lobe These nuclear changes were also noted by Hare and his associates in the pituitary gland removed from a patient with carcinoma of the adrenal gland

MacCallum and his co-workers found in their case of basophile adenoma that the basophile cells of the neoplasm, as well as those of the pars intermedia, remained unstained with copper hematoxylin, whereas the basophiles of the anterior lobe stained black For this reason, they believe the tumor is derived from the pars intermedia cells

Recently, Cushing (16) has demonstrated the presence of basophilic infiltration of the pars nervosa of pituitary glands in 6 fatal cases of eclampsia In 4 cases in which the patients had shown marked hypertension, an excessive basophilic infiltration of the posterior pituitary gland was found A similar condition has been observed by Cushing in a number of glands from fatal cases of essential or nephrovascular hypertension The hypertension, as well as the other effects, such as the derangements of fat, carbohydrates and water metabolism (obesity, hyperglycemia, edema, polydipsia, polyuria) encountered so regularly in pituitary basophilism, are doubtless manifestations of posterior lobe activation resulting from the secretory activity of the basophilic cells

However, controversial evidence exists only regarding the character of the endocrine principle produced by the overactive basophilic elements Zondek, for example, concludes in his study that prolactin is derived from the basophilic elements of the anterior lobe Anselmino and his co-workers showed that the blood of eclamptic patients with edema and hypertension contains antidiuretic and pressor substances They believe that an overproduc-

tion of posterior pituitary hormone offers the only proper explanation of the posterior pituitary phenomena met with in basophilism, eclampsia, and essential hypertension

It, therefore, is justifiable to assume, for the time being at least, that the hypertensive disorders and sequelae as well as posterior pituitary manifestations encountered in basophilism have their source in the posterior lobe of the pituitary body, and that the symptoms are induced by secretory activity of the excessive production of basophilic elements

TREATMENT

In cases in which the syndrome is present, coinciding with that found in the verified cases of pituitary basophilism, treatment should be directed to the pituitary gland. Exceptions to this rule should be made only in those cases in which definite evidence of adrenal neoplasm is obtained

The best procedure, in cases in which the causative lesions cannot definitely be determined, is to administer deep roentgen therapy to the pituitary. If prolonged thorough roentgen treatment of the gland fails to bring about progressive improvement in the endocrine condition, exploratory operation on the adrenal glands may then be considered

Roentgen therapy had been employed in 7 cases described in Table I. In the case reported by Wright, noticeable improvement in the health of the patient took place following x ray therapy until death intervened after an appendectomy

Two courses of deep roentgen therapy were applied to the pituitary gland in the case described by Craig and Cran, but death from pneumonia occurred before improvement was noted

Roentgen therapy had been used in several other cases listed in our study, but the patients had been so seriously affected by cardiovascular and other organic changes that death supervened before the effect of this method of therapy could be evaluated

Radiation of the pituitary gland has, in some instances, caused the disappearance of all the abnormalities in patients showing the symptoms of this syndrome. In the cases reported by Jamn, Wohl, and others, pro-

nounced improvement followed deep x ray therapy. The question of x ray treatment of unverified cases, however, is a subject which will be discussed in a later report.

On the assumption that the manifestations of Cushing's syndrome are due in large part to adrenal hyperactivity, Crile and associates have performed denervation and partial resection of the adrenal glands in cases of this character and obtained alleviation of the symptoms

Oppenheimer states that it seems to him, "in a particular case after a tentative trial of roentgen therapy to the brain without improvement, one should explore both adrenals surgically, possibly, also the ovaries, seeking to find a tumor, the removal of which may cure the patient." On the other hand, Kepler and associates who obtained some degree of success in operative removal of adrenal adenomas, and resection of hyperplastic adrenal tissue, believe it a better plan to operate first on the adrenal glands and to treat the pituitary gland later, if no pathological alteration in the adrenals is found. However, this procedure, it seems to the writers, may unnecessarily expose the patients to the dangers of surgical maneuvers which may not prove of benefit

SUMMARY

1 The clinical course of a personal case of pituitary basophilism in a girl 20 years old under observation for a period of 3 years is described. Osteoporosis and hypertension, two symptoms usually found, were not present in the case recorded. The patient made a pronounced improvement after receiving several courses of deep roentgen irradiation to the pituitary gland

2 The special features of 42 verified cases of pituitary basophilism are tabulated and analyzed. A definite diagnosis of basophilic adenoma was made in 35 cases, an increase in basophilic cells was reported in 1 case. A chromophobe adenoma was successfully removed by operation in 1 case. In the 5 remaining patients, the pituitaries disclosed adenomas composed of chromophobe or eosinophilic elements

3 Thirty two patients were female, and 10 were male

4 The most conspicuous clinical features of basophilic adenoma are as follows (1) plethoric obesity, especially of the face, (2) hirsutism, (3) amenorrhea (impotence or loss of libido in the male), (4) cutaneous striae, (5) osteoporosis, (6) hypertension, and (7) glycosuria

5 Other symptoms of prominence are headache, asthenia, pains in the extremities, polyphagia, polydipsia, and symptoms referable to the cardiovascular and respiratory systems

6 Death in the recorded cases was usually due to infections of various types or pulmonary complications. Patients with basophilic adenoma of the pituitary cannot withstand any type of infection, not even one of a minor nature

7 Hypertrophy of the adrenals was an associated finding in 18 or 63 per cent of 29 cases in which the adrenal condition was described. In 3 cases definite adenomas of the adrenals were also present. The association of adrenal hypertrophy and adenomas is also encountered and has long been known to be a definite association of acromegaly

8 Five patients were operated upon for suspected adrenal neoplasms and all died following operation. In only 1 patient was an adrenal tumor found to be present at the time operation was performed. Later at autopsy a minute basophilic adenoma was discovered in the pituitary gland

9 Therapy for patients exhibiting the manifestations of Cushing's syndrome should consist in deep roentgen (high voltage) irradiation of the pituitary gland. Irradiations of high dosage should be employed (300 to 1200 r units to each side of the head). This should be repeated every 4 to 6 months, if only slight or no improvement occurs. Patients with this syndrome apparently withstand large exposures of irradiation very well and show no ill effects

10 Finally, the authors believe that patients with the clinical syndrome of pituitary basophilism should not be exposed to the risks of adrenal exploration, unless definite evidence of tumor is found, or repeated high voltage irradiation therapy has failed to bring about improvement

BIBLIOGRAPHY

- 1 ACHARD, C, and THIERS, J. Le virilisme pilairé et son association à l'insuffisance glycolytique (diabète des femmes à barbe). *Bull de l'acad de med*, 1921, 86 51-66
- 2 ANDERSON, J. A case of polyglandular syndrome with adrenal hypernephroma and adenoma of the pituitary gland. *Glasgow M J*, 1915, 83 178-192
- 3 ANSELMINO, K. J., HOFFMANN, F., and KENNEDY, W. P. The relation of hyperfunction of the posterior lobe of the hypophysis to eclampsia and nephropathy of pregnancy. *Edinburgh M J*, 1932, 39 376-388
- 4 BAUER, J. Ueber Funktion des gesamten Nebennierensystems ohne anatomischen Befund. *Wien klin Wchnschr*, 1930, 43 582-586
- 5 BERBLINGER, W. Die Korrelationen zwischen Hypophyse und Keimdruesen. *Klin Wchnschr*, 1932, 11 1329
- 6 BISHOP, P. M. F., and CLOSE, M. B. A case of basophil adenoma of the anterior lobe of the pituitary. *Guy's Hosp Rep*, 1932, 82 143-153
- 7 BRAUCHLI, H. Beitrage zur pathologischen Anatomie der Hypophyse. *Frankfort Ztschr f Path*, 1925, 31 459-478
- 8 CAILL, G. F. Air injections to demonstrate adrenals by X-ray. *J Urol*, 1935, 34 238-243
- 9 CHRISTELLER, E. Die Rachendachhypophyse des Menschen unter normalen und pathologischen Verhältnissen. *Arch f path Anat*, 1914, 218 185-223
- 10 COSTELLO, R. T. Subclinical adenoma. *Am J Path*, 1936, 12 205-216
- 11 CRAIG, J., and CRAN, B. Basophil adenoma of the pituitary gland. *Quart J Med*, 1934, 3 57-62
- 12 CRILE, G., TURNER, R., and McCULLAGH, P. Polyglandular disease. *New York State J M*, 1936, 36 7 375-484
- 13 CUSHING, H. Papers relating to the pituitary body, hypothalamus, and parasympathetic nervous system. Springfield, Illinois: C. C. Thomas, 1932
- 14 Idem. "Dyspituitarism" twenty years later, etc. *Arch Int Med*, 1933, 51 487-557
- 15 Idem. Hyperactivation of the neurohypophysis as the pathological basis of eclampsia and other hypertensive states. *Am J Path*, 1934, 10 145-175
- 16 Idem. Further notes on pituitary basophilism. *J Am M Ass*, 1932, 99 281-284
- 17 Idem. The basophil adenomas of the pituitary body and their clinical manifestations (pituitary basophilism). *Bull Johns Hopkins Hosp*, 1932, 50 137
- 18 ERDMAN, J. Zur normalen und pathologischen Histologie der Glandula thyroidea, parathyroidea und Hypophysis. *Beitr z path Anat u z allg Path*, 1903, 33 158-236
- 19 FREYBERG, R. H., BARKER, P. S., NEWBURN, L. H., and COLLIER, F. A. Pituitary basophilism (Cushing's syndrome), etc. *Arch Int Med*, 1936, 58 187
- 20 FULLER, C. J. Chromophobe adenoma of the pituitary associated with Cushing's syndrome. *Lancet*, 1936, 2 181-183
- 21 GALLAIS, A. Le syndrome génito surrénal. Thèse de doct., Paris, 1912
- 22 GOLDBERG, M. M. A pituitary syndrome: report of a case. *Arch Neurol & Psychiat*, 1935, 34 631-634
- 23 GOULEY, B. A. Basophilic adenoma of the pituitary. Report of a case of "pituitary hypertension" terminating in cerebral apoplexy. *Ann Int Med*, 1935, 8 1294-1301

- 24 GREFFI L, and REDAELLI, P. Ricerche clinico anatomiche sopra un caso di obesità a base ipofisaria surrenale (sindrome di Cushing) Boll soc med chir, 1934 2 509-521
- 25 HARE DOROTHY C ROSS J M and CROOKE A C Cortical carcinoma of the suprarenal, with Cushing's basophil pituitary syndrome Lancet, 1935 2 118
- 26 HILDEBRAND K H Zum basophilen Hypophysenadenom Cushing's (mit funktionellen Prüfungen) Klin Wchnschr 1935 14 951-957
- 27 HORA F Případ Cushingova syndromu Bratislav lek Listy 1935 15 242-261
- 28 HORNECK K Zur Klinik des Morbus Cushing Ztschr f klin Med 1935 129 191-197
- 28a JAMIN F Die hypophysäre Isthora München med Wchnschr 1934 28 and 29
- 29 JONAS V Morbus Cushing Casop lek česk 1935, pp 1313-1318 1349-1353 1372-1377 1413-1418 1439-1442, 1462-1467
- 30 JOSEPHSON A and BERGSTRAND, H Nord med tidnkr 1934 8 1277
- 31 KEPLER E J KENNEDY R L J DAVIS, A C WALTER W and WILDER R M Suprarenocortical syndrome and pituitary basophilism presentation of three new cases Proc Staff Meet Mayo Clin 1934 9 160-181
- 32 KLEIN F and WAGNEROVA HATRIKOVA H Příspěvek k patogenézi Morbus Cushing Rev v neurol a psych 1935 32 40-55
- 33 KRAUS E J Zur Pathogenese der Dystrophia Adiposogenitalis Med Klin 1924 20 1290-1292
- 34 LAWRENCE J H and ZIMMERMAN, H M Pituitary basophilism Arch Int Med 1935 55 745-759
- 35 LESCHER F G Comparison of pituitary basophilic syndrome and adrenal corticogenital syndrome With report on pathology by A H T Robb-Smith Quart J M 1935 4 23
- 36 LEYTON O Multiglandular disease Lancet 1934, 1 1221-1226
- 37 LITTON O TURNBULL H M and BRATTON A B Primary cancer of the thymus with pluriglandular disturbance J Path & Bacteriol 1931, 34 635
- 37a LISSER H In discussion of MacCallum Lib cit
- 38 MACCALLUM W G FUTCHER T B DUFF C L and ELLSWORTH R Cushing syndrome relation to pars intermedia of hypophysis. Bull Johns Hopkins Hosp 1935 56 350-365
- 39 MACMAHON H E CLOSE, H G, and HAAS, G Cardiovascular renal changes associated with basophil adenoma of the anterior lobe of the pituitary (Cushing syndrome) Am J Path 1934 10 177
- 40 MARBURC O Ueber das basophile Adenom der Hypophyse die cerebrale Fettsucht und die Pseudohypertrophie Arb a d neurol Inst a d Wien Univ 1933 35 145-160
- 41 MINICOTTI G Correlazioni endocrine della iperipofis e morbo Cushing Fisiol e med 1935 6 685-726
- 42 MOELLIG R C Basophilic adenoma of the pituitary J Am M Ass 1932 99 1488-1500
- 43 MOLINEUS Ueber die multiplen braunen Tumoren bei Osteomalacie Arch f klin Chir, 1913 101 333
- 44 NAEGLI O Inaugural Dissertation, Zurich, 1916
- 45 OPPENHEIMER B S GLOBUS, J H SILVER, S and SHASKIN D Suprarenal vrilism and Cushing's pituitary basophilism Tr Ass Am Physicians, 1935, 50 371-387
- 46 JARRES WEBER, F Cutaneous striae, purpura, high blood pressure amenorrhea and obesity, of the type sometimes connected with cortical tumours of the adrenal glands occurring in the absence of any such type of tumour Brit J Dermat & Syph 1926 38 1-19
- 47 RAAB, W Klinische und roentgenologische Beiträge zur hypophysären und cerebralen Fettsucht und Genitalatrophie Wien Arch f inn Med. 1924, 7 443-530
- 48 RASMUSSEN A T The relation of the basophilic cells of the human hypophysis to blood pressure Endocrinol, 1936 20 673-680
- 49 REICHMANN V Ueber ein ungewöhnliches Krankheitsbild bei Hypophysenadenom Deutsche Arch f klin Med, 1919, 130 130-150
- 50 RUSSELL, D S EVANS H and CROOKE A C Two cases of basophilic adenoma of the pituitary gland. Lancet, 1934 227 240
- 51 RUTISHAUSER, E Osteoporotische Fettsucht. Deutsche Arch f klin Med, 1933 175 640-680.
- 52 SALUS, F Zur Kenntnis der malignen Hypophysenadenoma Ztschr f d ges Neurol u Psych, 1933 148 574-583
- 53 SCHMORI C G Ein Fall von deformierender Osteitis. München med Wchnschr 1912, 59 2891
- 54 SIMMONDS M Ueber Kachexie hypophysären Ursprungs Deutsche med Wchnschr 1916, 42 190-191
- 55 SUSMAN W Adenoma of the pituitary, with special reference to pituitary basophilism of Cushing Brit J Surg 1935 22 539-544
- 56 SWAN, W G A and STEPHENSON, G E Basophilic adenoma of the pituitary body Lancet 1935, 1 372-374
- 56a TEEL, H M Basophilic adenomas of the hypophysis with associated pluriglandular syndrome Arch Neurol & Psychiat 1931 26 593-599
- 57 WALTERS, W WILDER R M, and KEPLER E J The suprarenal cortical syndrome with the presentation of ten cases Ann Surg 1934 100 6, 0
- 58 WIETH PEDERSEN G Et Tilfælde af Binyretumorig et af Hypofisetumor med Binyrehyperplabegge med Striae distensae cutis Hosp Tid, 1931 74 1231-1244
- 59 WILDER R M Polyglandular dyscrasias involving abnormalities of sexual characteristics. Proc Staff Meet Mayo Clin, 1933 8 97-110
- 60 WOHL, M G MOORE J R and LOUG B R Basophilic adenoma (pituitary basophilism) Radiol 1935 24 53-57
- 61 WRIGHT C A Pituitary basophilism Med Rec, 1935, 141 181-196
- 62 ZONDEK B Prolin in der Hypophyse Klin Wchnschr, 1935, 12 22-25
- 63 ZONDEK, H Die Krankheiten der endokrinen Drüsen Berlin J Springer 1923

ROENTGENTHERAPY IN EPITHELIOMAS OF THE MAXILLARY SINUS

J A DEL REGATO, Paris, France

AT THE present time the technique most widely used in the treatment of epitheliomas of the superior maxillary region is an atypical resection of the superior maxilla, either by cold steel or diathermy, followed by irradiation of the cavity by means of tubes of radium placed in the interior of the operative field. Telecurietherapy or roentgentherapy, before or after operation, however, are used in addition in certain clinics. These procedures give an appreciable percentage of cure in expert hands.

In a total of 72 patients with epitheliomas of the maxillary sinus, admitted for treatment at the Foundation Curie from 1919 to 1934, a small group of 10 patients was treated by roentgentherapy alone. It is this group of patients which forms the basis of this work.

CLINICAL STUDY

The early diagnosis of epitheliomas of the maxillary sinus is exceptional. The tumor forms in a cavity where it can develop silently without causing symptoms. At times there is a slight serous discharge from the nose which, unassociated with pain, is confounded with simple coryza. Sometimes, in those forms arising in the suprastructure of the maxilla, the patient notes, 2 or 3 months before the first painful symptoms, nasal hemorrhage which may last for several hours, yet which rarely leads to an early diagnosis.

The alarming symptoms appear when the tumor invades the neighboring regions and opens a tract from the sinus. These symptoms vary according to the site of origin of the growth. A classification of these sites of origin is thus necessary and of importance both in arriving at a diagnosis and in deciding upon the method of treatment.

Suprastructure. Tumors which arise in the superior half of the maxillary sinus at the on-

Institut du Radium de l'Université de Paris. Professor Cl Regaud. Service de Roentgentherapie de la Fondation Curie. Dr Coutard.

set have the most dormant development. As soon as they invade the orbital cavity, however, the distortion of the region makes the diagnosis easy. These tumors fall into two groups: the external and the antero-internal.

Tumors of the suprastructure which grow *externally* arise in the summit of the pyramid shaped antrum. They rapidly invade the malar bone, but cause only slight infra-orbital pain. A tumefaction of the external angle of the floor of the orbit then appears and there is an associated infra-orbital, frontal, and temporal pain, which increases as the tumor grows larger. Invasion of the orbital cavity is brought about by infraction of the external part of the orbital floor. The eye is deviated upward and inward, the palpebral fissure becomes oblique from within outward and from below upward (Figs 6 and 8). The temporal fossa is affected by invasion of the zygomatic process or through the external wall of the orbit. Adenopathy, rare in these cases, is limited to a small pre-auricular gland.

The *antero-internal* tumors arise on the uppermost portion of the anterior wall of the sinus at the junction with the nasal fossa. The patient complains of slight infra-orbital pain and there is a progressively increasing nasal discharge and obstruction. One frequently finds in these patients large polyps involving the turbinates, the polyps may have been removed on several occasions but without establishing the diagnosis of neoplasm. The tumor gradually deforms the infra-orbital region, the lacrimal sac becomes infected, suppurates, or is invaded, and pain—infra orbital, medial, frontal, and parietal—sometimes very intense, makes its appearance (Fig 1).

The invasion of the floor of the orbit results from the infraction of the internal half. The eye is displaced upward and outward, tending more and more to become exteriorized. The anterior ethmoidal cells are affected from the

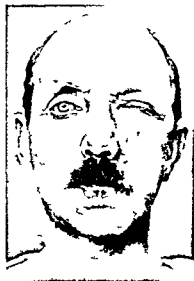


Fig 1 Epithelioma of the suprastructure of the maxilla. Antero-internal form

beginning as is at times the frontal sinus. We have never observed adenopathy in this form.

Infrastructure Infrastructure tumors develop in contact with the dental roots and their nerves. Alarming symptoms are therefore observed earlier in the course of development than in those tumors of the suprastructure. However, although the patient may consult his dentist early, the diagnosis of neoplasm is often established late.

Antero-external tumors arise in the anterior part of the sinus, at the union of the antero-external wall and the septum dividing the sinus and the nasal fossa. The patient may seek consultation because of pain of dental origin which may accompany the loosening of the tooth, a premolar or the first molar tooth may be affected. After extraction of the tooth the pain persists. The diagnosis of dental cyst may then be made, and it is often during the course of operation for this cyst that the real diagnosis is made.

Development of the tumor first takes place anteriorly and laterally, becoming so large that at times there is considerable disfigurement to the maxillary region (Fig 2). The naso-antral wall and the inferior turbinate are displaced medially, thus gradually obstructing the nasal cavity.



Fig 2 Epithelioma of the infrastructure of the maxilla. Antero-external form

Invasion of the hard palate through the alveoli and the displacement of the mucosa into the gingivobuccal sulcus progresses rapidly without eliciting very great pain. Submaxillary adenopathy is observed often in these patients and especially after buccal invasion has begun.

Posterior tumors arise at the junction of the postero-inferior and internal walls of the sinus. It is the rarest form and that in which the diagnosis is most tardy. Pain is often the first symptom and is diffuse. Its cause is usually attributed to an accident to a wisdom tooth, an unerupted tooth, or a dental cyst. Trismus often appears early or closely follows the pain. The posterior molars become loose and fall, if they have not already been extracted due to an error in diagnosis.

The tumor grows inwardly toward the pterygomaxillary fossa and the swelling is noticed externally. Ethmoidal invasion takes place through the posterior ethmoidal cells. Superior carotid and angulomaxillary adenopathy is not rare.

Secondary infection These tumors have a marked tendency to spontaneous necrosis and once having opened into the buccal cavity or nasal fossa, they present a large gangrenous

surface, infected, and with a necrotic odor. This secondary infection is neither a contraindication nor an obstacle to treatment.

It has been noted that all the tumors of the buccopharyngeal regions—voluminous, proliferating, infected, and malodorous—benefit greatly by irradiation, which seems to be for them the most efficacious of disinfectants. Moreover, many of these tumors are highly sensitive to radiotherapy.

Infection associated with epithelioma of the maxillary sinus in particular becomes an obstacle only when the infection involves the other sinuses thus provoking a purulent pansinusitis.

Malignancy. Although these tumors are considered to be highly malignant, they seem to react differently, in fact, (1) no instance of distant metastasis has been observed, (2) invasion of the glands is rarely early, (3) patient remains in good general condition for a long time.

ROENTGENOGRAPHY

Roentgenographic study of the maxillary sinus is of great value in establishing the true extent of the lesion. The tumors, on clinical examination, often appear localized to one or another portion of the maxillary structure, but with the x ray they are found to be of much greater extent. The roentgenogram reveals not only the extent of the invasion, but the condition of the maxillary and malar bones, of the floor of the orbit, of the hard palate, at times it reveals that the lesion has spread even into the pterygomaxillary fossa. These facts are not always brought out in the clinical examination nor does the symptomatology reveal them.

Roentgenographic examination often demonstrates an opacity of the ethmoid cells and frontal sinus. In the absence of bone infraction or destruction, this opacity does not indicate definitely a neoplastic invasion of these regions. It does point to the possibility of such an invasion and is an indication that these regions should necessarily be included in the field of irradiation.

HISTOPATHOLOGY

The majority of tumors of the superior maxilla are epitheliomas. The lymphosar-

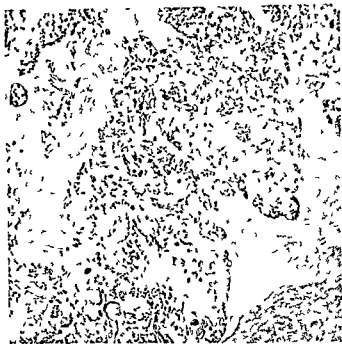


Fig. 3 Epidermoid pavement epithelioma of the maxillary sinus. Variety of epithelioma most often encountered. $\times 50$.

comas found in this region are usually the result of propagation from tumors arising in the nasopharynx. The proportion of connective tissue tumors to epitheliomas is about 1 to 10. For a long time benign giant cell tumors of the maxilla have been included with the connective tissue tumors of the region, and thus it came to be believed that connective tissue tumors were as frequent as epitheliomas. In reality such tumors are rare.

Epitheliomas of the maxillary sinus which arise from a cylindrical mucosa susceptible to metaplasia, in the great majority of cases, belong to the group of *epidermoid pavement epitheliomas*. They have the characteristics of tumors which arise from epidermal coverings: stratification of the cellular elements and successive transformation of these to resemble elements of the skin and dermopapillary mucosae. Eight of our 10 cases belong in this group. In addition they all present a *mucosal type of epidermoid evolution*, with stratification most often complete, sometimes alternating, but with basal cells predominating, and with keratinization by foci or isolated cells rather than by the formation of epithelial pearls (Fig. 3).

Large, clear cells presenting monstrosities

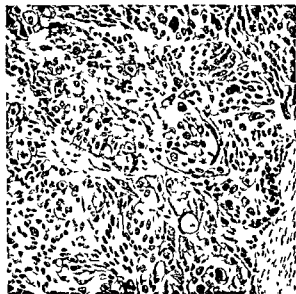


Fig. 4 Epidermoid pavement epithelioma of the maxillary sinus Same case as in preceding figure $\times 1,0$

are often observed, recalling those seen in epitheliomas recently irradiated (Fig. 4). Mitoses are usually numerous. Spontaneous necrosis in the center of the sheets of cells is frequent.

Two of our cases were *non epidermoid epitheliomas*. One was composed of small uniform cells architecturally arranged in large sheets or conjoined nodules, and proved to be very radiosensitive. The other was a massive epithelioma which had invaded the muscle, and contrary to the finding in the first case, was only slightly radiosensitive.

TREATMENT

All these patients were treated by roentgenotherapy alone, for the reason that it would have been impossible to remove the lesion completely no matter how extensive the surgical extirpation.

Dental extractions. A wise precaution is to extract before treatment all the teeth of the superior and inferior maxillæ of the affected side no matter what their condition and as well all other teeth of the opposite side in questionable repair. We believe that it is preferable to extract generously. Teeth in bad condition are often the cause of early necrosis of the maxilla. One of our patients refused

extraction, and at the completion of treatment presented necrosis of the inferior maxilla, its origin and development from and around a dental root could be followed.

Following irradiation of tumors of the pharynx and oral cavity, very often late dental lesions are observed, even in the teeth which are in good condition before irradiation. These dental lesions, which vary in severity and in rapidity of development, at times constitute multiple portals of entry for infection which, when it reaches the irradiated maxilla, may cause a late necrosis and jeopardize the cure of the patient. A patient who had been pronounced cured of an epithelioma of the hard palate returned 6 months after treatment presenting dental lesions which had caused necrosis of the inferior maxilla. We have just observed two other patients who were cured of epitheliomas of the tonsil 8 years ago and who developed dental lesions. At the present time both patients have necrosis, one patient of the inferior maxilla, the other of the superior maxilla.

We believe, therefore, that in all patients subjected to irradiation of the oropharyngeal regions, the safest procedure is to remove all teeth, especially if the teeth are not in good condition and to await for complete healing of the gums before irradiation is begun. One is often obliged to be content with a less radical procedure.

Physical factors. The voltage employed has been from 180 to 200 kilovolts. If the tumor remains localized and especially if it is superficial, it seems sufficient to sterilize these tumors. The intensity of the secondary current in the tube has been 3 to 4 milliamperes, it is probable, however, that these forms of cancer with relatively slight differentiation could be treated without ill effect with higher intensities.

The anticathode skin distance we use is 50 to 60 centimeters. The average hourly dose has been from 150 to 250 r per hour, or 25 to 4 r per minute. The filtration has been 2 millimeters of copper and 3 millimeters of aluminum.

Portals of entry. Two unilateral fields of 70 to 120 square centimeters have most often been used—one anterior and the other lateral,

each covering the entire primary lesion. There is therefore a large zone of superimposition. Sometimes a third field, with the rays applied over the opposite side has been used, but the first two portals of entry are the most important and usually suffice.

If there exists a submaxillary or carotid adenopathy, it may not be practicable to include both the primary lesion and the gland area in one field. In such cases, it may be preferable to use an additional field to cover the gland area. If the adenopathy is only suspected or is not voluminous, it can be treated after the primary lesion.

Ocular protection. In the lesions limited to the infra-maxillary structure of the superior maxilla, the eye is outside the zone of invasion, hence is not irradiated. In the extensive cases, however, or in those in which the growth is limited to the suprastructure, the eye is in contact with the neoplastic mass and must necessarily be subjected to irradiation.

If the eye receives the total dose necessary to sterilize the tumor, there is produced a more or less serious injury to the eye, depending on the intensity of the treatment.

1 If treatment consists of intense daily doses given over a short period of time, there is produced an ulcer on the cornea which, in the months following treatment, may necessitate enucleation.

2 If the treatment is of moderate intensity, the eye may remain intact, but there is a definite epilation of the lids accompanied by chronic conjunctivitis with tearing which can be more uncomfortable to the patient than the loss of the eye.

3 If the treatment is of low intensity, there is no definite epilation of the lids and the patient conserves normal vision. At the end of 2 or 3 years, however, the vision becomes less acute and finally is lost.

If the treatment is prolonged over several weeks, the eye can be protected after the first portion of the irradiation has acted upon the periphery of the tumor. In one of our patients, Case 7, who received 7300 r in 42 days, the eye was protected after having received 2500 r in the first 25 days of treatment and normal vision is conserved at the present time, 5 years after treatment (Fig. 9).



Fig. 5 Epithelioma of the suprastructure of the maxilla treated by roentgentherapy in 12 days, Case 2. Loss of eye. Late radionecrosis of skin healed. Cure of 15 years' duration.

The fields are irradiated without protection of the eye of the affected side, during the first 3 or 4 weeks of treatment, during the course of which a dose of about 2000 to 2500 r is administered. Irradiation is then continued but the eye is protected by means of a shadow projected on it by a lead rod 5 millimeters in thickness and 1.5 centimeters in diameter, which, placed at a distance of 15 to 20 centimeters from the eye in the beam of the rays, stop those rays which could otherwise fall directly upon the eye and on the borders of the lids (protection at a distance). Toward the end of the treatment one adds to this protection an oval shell of lead encased in wax, 3 millimeters in thickness and 2.5 by 3 centimeters in diameter, which is placed either directly in front of, or lateral to, the eye in the path of the anterior or lateral beam (direct protection).

Prolongation of treatment. The duration of the treatment depends upon the clinical conditions in the individual case and upon the anatomical characteristics of the region irradiated. For instance, epitheliomas histologically slightly differentiated, as those of the maxillary sinus, can be sterilized as well by treatment over a short period of only 15 days as over a longer period of 40 to 50 days.



Figs 6 and 7 Case 4 Epithelioma of the suprastructure of the maxilla, external form Roentgentherapy in 18 days Loss of vision of left eye 2 years after treatment Atrophy and telangiectasis of skin Cure of 7 years duration At left taken in 1930 at right in 1937

On the other hand, the anatomy of the region and the conservation of healthy tissue traversed by the beam leads one forcibly toward treatment prolonged over several weeks. Our conclusions from cases treated are as follows:

1. Treatments extending over a period of 2 weeks or less rarely produce sterilization of the neoplasm, in fact, if sterilization is secured it is at the expense of the eye, which must be enucleated. Also there are the concomitant radio necrotic accidents to the skin or bone from which the patient does not always survive. Such short courses of treatment are not advisable even when only palliative treatment is attempted, for they provoke a rapid sloughing of the neoplasm and this is followed by a lowering of the general condition. Death may result very rapidly from such a procedure, especially in older patients.

2. Treatment extended over 3 to 4 weeks can produce sterilization but there is always the possibility that vision in the irradiated eye will be sacrificed because in treatment over such a short period of time protection of the eye might compromise the cure, moreover, skin modifications—atrophy, telangiectasis, sclerosis—are always marked.

3. Treatment extended over 5 to 6 weeks permits of sterilization under the most favorable conditions, with conservation of the eye and vision because the eye can be protected during part of the treatment. Skin modifications are minimum or absent, and the cosmetic results are perfect.

4. Treatment prolonged over more than 6 weeks gives an appreciable palliative result, especially in a very advanced case, with the patient in poor general condition, but sterilization of the tumor is rarely accomplished and is usually followed by recurrence. However, recurrence is very slow in contrast to the rapid development of the tumor before treatment.

Clinical control during treatment. Daily observation and examination of patients are without doubt the most important factors in the conduct of treatment. It is only by closely following the patients that one can adapt the daily dose to the exigencies of the varying local and general conditions, rarely does a patient benefit from routine treatment. Individual peculiarities as to ocular, skin, and cutaneous reactions are among the factors which demand the daily careful examination of the patient.

Total dose. The total dose administered



Figs 8 and 9 Case 7 Epithelioma of the suprastructure of the maxilla, external form Roentgentherapy in 42 days Conservation of vision No trace of irradiation on skin Cure of 5 years' duration At left, 1932, at right, 1937

varies with the period of time covered in the treatment. A dose of 4000 r—measured on the skin—given in 14 days through two fields on the same side of the face, causes at times great suffering both local and general, but a dose of double that magnitude, 8000 r given under the same conditions but over a period of 87 days, as in one of our patients, was insufficient to sterilize the neoplasm, but caused no local or general accidents.

For a treatment extending over 5 or 6 weeks, the total effective dose seems to vary between 6000 and 7000 r administered through two fields on the same side of the face. These doses closely approach the limits of danger.

Daily dose Almost all of our patients have received continuous treatment, daily or twice daily, the average dose has thus varied, depending on the prolongation of the treatment, between the extreme limits of 130 to 700 r per day.

In a continuous treatment, extending over 5 to 6 weeks, the average daily dose is 200 to 250 r, but this dose must not and cannot be systematically applied day by day. It represents only an average of the total treatment. The daily dose must pass from maximum to

minimum, depending upon the effect of the irradiation.

Reactions Beginning with the first days of treatment the external portions of the tumor are covered with false membranes—an indication of the characteristic sensitiveness of this type of tumor. Even with low daily doses these false membranes often persist until the total disappearance of the neoplasm.

If the treatments given are of moderate or high dosage, there appears between the twelfth and fifteenth days a reaction of the normal mucosa, a mucosal radio-epithelitis involving the mucosa of the gingivobuccal sulcus and extending finally to the palate and upper lip. If at this time the treatment is stopped or the daily dose is lowered, the mucous reaction disappears after 7 to 10 days. However, if the high dosage treatment is continued, the condition tends to persist.

At the end of the fourth week the epidermis, which has become very red over the cheek, is denuded, a radio-epidermitis is produced which is usually exudative in type, due to the two superimposed fields on the antero-external part of the cheek. Complete healing takes place in 8 to 10 days. In extended treatments



Fig 10 Case 6 Epithelioma of the infrastructure of the maxilla and submaxillary and carotid adenopathy. Treated by roentgentherapy in 48 days. Palatine perforation closed. No trace of irradiation on skin. Cure of 6 years duration.

the radio epidermitis results at times in only dry desquamation.

The lids and conjunctivæ also react, becoming edematous and congested, with epila-

tion of the lids. Care must be used in such cases to avoid infectious complications.

STUDY OF RESULTS

The radiosensitivity of epitheliomas of the maxillary sinus is generally great, about equal to that of the lympho epitheliomas.

Five of our 10 patients had very extensive tumors and none of these has survived (Table I). Two of these patients died 2 or 3 weeks after treatments of short duration which brought a general weakened condition. Two others died, one 6 months and the other 18 months after treatment, with recurrence complicated by necrosis of the maxilla. Finally, the last patient died 18 months after treatment extending over almost 3 months, followed by gradual recurrence.

The 5 other patients had lesions more or less localized in the suprastructure or infrastructure of the maxilla. Four of these patients remain cured, the longest period being 15 and the shortest 5 years. Two of these tumors were of the infrastructure one, Case 10, after treatment and local healing, developed submaxillary adenopathy of rapid evolution and the patient died 6 months after

TABLE I—SUMMARY OF PATIENTS TREATED

Case	Series	Year	Sex Age	Side	Clinical condition	Histology	Duration treatment	Results
1	IX A 0	1900	F 74	R	Very extensive No adenopathy	Non-epidermoid epithelioma	14 days	General condition enfeebled. Died 10 days after treatment of cardiac complications.
2	IX A 5	1922	M 53	L	Suprastructure No adenopathy	Epidermoid epithelioma	12 days	Loss of eye. Late radionecrosis of skin. Cure of 15 years duration.
3	IX A 65	1928	M 42	L	Very extensive No adenopathy	Epidermoid epithelioma	15 days	Early necrosis of inferior maxilla of development. Recurrence and necrosis of superior maxilla. Died 18 months after treatment.
4	IX A 69	1930	F 62	L	Suprastructure No adenopathy	Epidermoid epithelioma	18 days	Loss of vision 2 years after treatment. Cure of 15 years duration.
5	IX A 0	1930	M 5	R	Very extensive No adenopathy	Epidermoid epithelioma	16 days	General condition enfeebled. Died 3 weeks after treatment.
6	IX A 73	1931	M 36	L	Infrastructure Sub- maxillary and cer- vical adenopathy	Epidermoid epithelioma	48 days	No trace of irradiation on skin. Cure of 6 years duration.
7	IX A 5	1932	M 56	L	Suprastructure, Ir- regular gland	Epidermoid epithelioma	42 days	No trace of irradiation on skin. Cure of 5 years duration.
8	IX A 6	1932	F 30	L	Very extensive No adenopathy	Epidermoid epithelioma	87 days	Gradual recurrence 3 months after treatment. Second irradiation with non-sterilization and necrosis. Died 18 months after treatment.
9	IX A 78	1933	M 50	L	Very extensive Car- otid gland	Non-epidermoid epithelioma	42 days	Non sterilization with necrosis. Died 5 months after treatment.
10	IX A 79	1934	M 59	R	Infrastructure Sub- maxillary gland	Epidermoid epithelioma	57 days	Subsequent development of adenopathy. Patient did not return for treatment. Died 6 months after initial treatment.

treatment, the other, Case 6, was an extensive lesion with cervical and submaxillary adenopathy and the patient is now cured after 7 years of observation, the communicating orifice between the sinus and buccal cavity having closed spontaneously, the cosmetic result is perfect (Fig 10). The 3 other cases were tumors localized in the suprastructure. They are all cured, but the cosmetic result is varied, as was noted in the discussion of prolongation of treatment. One patient, Case 2, was treated for 12 days, he developed a corneal ulcer and lost the eye after treatment, 1 year later he

developed late radionecrosis of the skin which required 4 years to heal. The cosmetic result is not enviable (Fig 5). The second patient, Case 4, treated for 18 days, did not lose the eye but the vision diminished to the point of complete loss 2 years after treatment, the skin bears traces of irradiation (Fig 7). Finally a third patient, Case 7, was treated for 42 days, which permitted adequate ocular protection, he remains cured and has almost perfect vision in the eye of the affected side after 5 years, the skin shows no trace of irradiation (Fig 9).

CYSTIC CHANGES IN THE ENDOMETRIUM

LAWRENCE M RANDALL, M D and WALLACE E HERRELL, M D, Rochester, Minnesota

THE term "cystic glandular hyperplasia of the endometrium" has come into use since the publication of studies by Schroeder. Numerous authors have contributed articles on this subject. The condition is presumed to occur as a result of a lack of function of the corpus luteum or because of the unopposed action of estrin on the endometrium in the presence of this failure or deficiency of the corpus luteum. It has been said that this condition of the endometrium is frequently associated with the presence of follicular cysts of the ovaries. Shaw affirmed that these cysts are an almost invariable accompaniment of the condition of cystic glandular hyperplasia. Burch and his coworkers said that if progestational changes, those due to the hormone of the corpus luteum, are present on microscopic examination of the endometrium one is not dealing with endometrial hyperplasia. The final accuracy of this statement must naturally be based on a combined study of the endometrium and the ovaries. Such studies have been made by Shaw and others, and in each series there have occurred instances in which corpora lutea were found. These have been considered to be either immature or old and non functioning.

The statement is often made that this so called endometrial hyperplasia occurs because of ovarian failure. The terms "ovarian failure" and "ovarian deficiency" often are loosely employed. It is generally agreed that when primary ovarian failure begins the functions of ovulation and formation of corpus luteum are the first to fail. As a result of this failure, production of estrin and the effect of estrin on the endometrium may proceed without the usual inhibition that is imposed by the function of the hormone of the corpus luteum. In this instance one cannot say that failure of the ovary as a whole has occurred for the pro-

duction of estrin persists and actually may be increased. Such a condition as this may exist for years without the usual manifestations of pituitary hyperfunction that follow failure of production of sufficient estrin to cause normal cyclic pituitary inhibition. The term "ovarian failure" should be qualified. The present state of our knowledge of the disturbances of the physiology of the female genital tract would seem to justify such qualification. In cases in which the term "cystic glandular hyperplasia" has been applied to the condition of the endometrium, one might specify failure or deficiency of corpus luteum function as the case might be. In these cases there is microscopic evidence that failure of the production of estrin and its effect on the endometrium has not occurred. There exists a stage of persistent proliferation as a result of lack of the effect of progesterin. Herrell and Broders previously have shown the value of a histologic study and classification of endometrial tissue arrested in its process of regeneration because of a deficiency in the stimuli which control this process.

The microscopic pictures of the cyclic changes that occur in the endometrium in response to the normal ovarian stimulation are recognized generally. The terminology applied to the various phases in this cycle is not universally the same. We believe that the effect of estrin on the endometrium is best denoted by the term "proliferation" and the effect of the hormone of the corpus luteum is best denoted by the term "differentiation". These terms seem best to describe the processes that are evident from microscopic study of the sequence of events that occur in the normal development of the endometrium. Other terms which have been given to the endometrium that show the effect of stimulation by progesterin are "secretory," "pregnand," or "progestational". These terms do not seem to correspond in a descriptive sense with the term "proliferative endometrium" that is

commonly applied to the histological picture during the estrogenic stimulation in the first half of the normal menstrual cycle. The terms that are applied to the histological picture of the endometrium when the normal sequence of the effects of estrin and progesterin have been intererred with are admitted by many writers to be inadequate and not entirely satisfactory. Thus the fully developed picture of the endometrium referred to as 'cystic glandular hyperplasia' represents complete failure of the function of the hormone of the corpus luteum, probably for a considerable time and to a considerable degree. The microscopic evidence of persistent proliferation or so called hyperplasia varies greatly in specimens of this type of endometrium. This variation probably depends on the amount and duration of stimulation from an unopposed effect of estrin. There is microscopic evidence that intermediate stages of corpus luteum failure exist in which evidence of differentiation of the endometrium, due to the action of the hormone of the corpus luteum, is incomplete. The history of spontaneous remissions of atypical bleeding and spontaneous recurrence, which is not uncommon among patients who have these degrees of hormonal deficiency, suggests that this is true. The varied symptoms, such as atypical bleeding, amenorrhea, and the occurrence of cystic endometrium among women who have normal menstrual periods, further suggest that there are degrees of loss of function of corpus luteum which may eventually lead to a persistent proliferative phase of the endometrium with cystic degeneration (cystic glandular hyperplasia).

Microscopic examination has been made of 278 specimens previously described (3). In 28 of these specimens cystic changes were found. The endometriums in which the cystic changes occurred represented all phases of the endometrial cycle, early and late proliferative and early and late differentiative, including the earliest evidence of stimulation with estrin and the complete differentiation which results from the action of progesterin. In the 28 cases in which cystic changes were present in the endometrium, the phases of the menstrual cycle were as follows: early proliferative phase in 5 cases, late proliferative phase in 8 cases,

early differentiative phase in 9 cases, and late differentiative phase in 6 cases.

In the 5 cases in which the endometrium was in the early proliferative phase, the specimens were removed 17, 22, 59, 90, and 199 days, respectively, after the first of the preceding uterine bleeding. None of the patients in these 5 cases gave a history of normal menstruation, 2 had a bleeding dysfunction (menorrhagia and metrorrhagia), 2 had irregular scanty periods and 1 had had amenorrhea for more than 6 months. Two patients in this group complained of inability to become pregnant. Two patients gave a history of removal of a cystic ovary prior to their visit to the clinic. None gave evidence of cystic ovaries at the time of examination.

The specimens of endometrium which were in the late proliferative phase of the menstrual cycle were removed on the 17th, 18th, 18th, 20th, 20th, 21st, 22nd, and 23rd day, respectively, after the first day of the last uterine bleeding. Four of the patients in these 8 cases gave a history of normal menstruation, 4 gave a history of menorrhagia and metrorrhagia, 5 complained of sterility, 1 had had a cystic ovary removed prior to her visit to the clinic, and the remaining ovary measured 3 by 5 centimeters at the time of her examination at the clinic. In 3 of these cases the basal metabolic rates were lower than normal. In 2 cases the basal metabolic rate was -17, in the other case it was -15. The menstrual histories were normal in these 3 cases.

In the 9 cases in which the endometrium was in the early differentiative phase of the menstrual cycle, 4 patients gave a history of a normal menstruation and 3 gave a history of bleeding dysfunction. Seven complained of sterility. Three had ovarian cysts at the time of examination and 1 had had a cystic ovary removed prior to her visit to the clinic.

In 4 of the cases in which the endometrium was in the late differentiative phase of the menstrual cycle the menstrual history was normal and in 2 cases the menstrual flow was scant in amount but the interval between periods was 28 days. Two patients in this group were found to have cystic ovaries. None of the patients in this group had bleeding dysfunction and all complained of sterility.

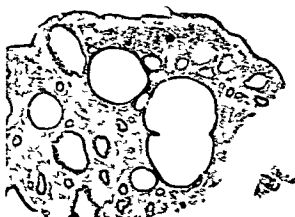


Fig. 1



Fig. 2



Fig. 3

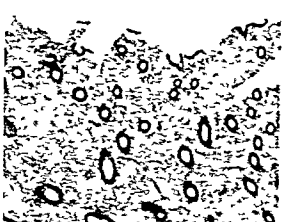


Fig. 4

Fig. 1. Persistent early proliferative phase of the menstrual cycle in a cystic endometrium. The normal glands in this section are identical with those shown in Figure 2; they are small straight tubular glands lined with low epithelium. This endometrium differs from normal endometrium only by the presence of several large cysts which are lined with flat epithelium. There is no actual increase, however, in the total number of glandular elements (previously called hypertrophied or hyperplastic endometrium). The average thickness of this endometrium is 1 millimeter. This specimen was stained with hematoxylin and eosin ($\times 17$).

Fig. 2. Early proliferative phase of the menstrual cycle in normal endometrium. This specimen was obtained on the fifth day of the normal menstrual cycle. The glands are of the straight tubular type. They are of small caliber and are lined with low proliferative epithelium. The average number of longitudinal glands per low power field is 5. The average thickness of this endometrium is 1 millimeter. This specimen was stained with hematoxylin and eosin ($\times 37$).

REPORT OF CASES

CASE 1. A woman, aged 30 years, came to the clinic because of menorrhagia and metrorrhagia. The first menstrual period had occurred when she was 14

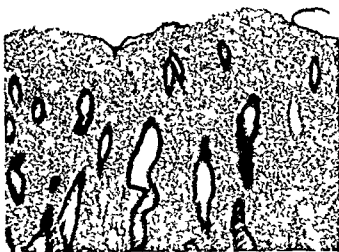
Fig. 3. Persistent late proliferative phase of the menstrual cycle in a cystic endometrium. The average thickness of this endometrium is approximately 2 millimeters. The glands are nearly identical with those found in the same phase of the cycle in a normal endometrium (Fig. 4) except that they are larger and are still of the straight tubular type. The average number of longitudinal glands per low power field is 6. This endometrium is approximately 1 millimeter thick. The only abnormality is the cystic appearance but this is not histological evidence of true hyperplasia. Specimen was stained with hematoxylin and eosin ($\times 17$).

Fig. 4. Late proliferative phase of the menstrual cycle in normal endometrium. This endometrium is approximately 2 millimeters thick. The average number of longitudinal glands per low power field is 6. The glands are still of the straight tubular type but they are increased in number. The glands are lined with proliferative epithelium. This type of endometrium is found from the 8th to the 14th day of the menstrual cycle. Specimen was stained with hematoxylin and eosin ($\times 37$).

years of age. The interval had been 35 days and the duration had been 7 days until the 2 year before she came to the clinic. Since that time the interval had varied from 2 to 6 weeks and the menstrual flow



Fig 5, left Persistent early differentiative phase of the menstrual cycle in a cystic endometrium. The longitudinal glands in this specimen are characteristic of the early differentiative phase. The glands are lined with columnar epithelium, and the glands also show convolutions which are normal (Fig 6) for the early differentiative phase, that is, the 15th to 21st day of the cycle. The average number of longitudinal glands per low power field is 6 to 7. The endometrium shown differs from the normal only by the presence of cystic areas lined by a flat non functioning epithelium. Some effect of the corpus luteum hormone is shown in the endometrium. However the absence of complete differentiation in the presence of cysts is indicative of par-



tial failure. Specimen was stained with hematoxylin and eosin ($\times 37$)

Fig 6 Early differentiative phase of the menstrual cycle in a normal endometrium. The specimen was obtained for biopsy on the 15th day of a normal menstrual cycle. This endometrium shows beginning differentiation. There are convolutions of the longitudinal glands and a transition to a columnar or differentiative type of cell. The endometrium is approximately 2.5 to 3 millimeters thick. The average number of longitudinal glands per low power field is 6 to 7. These are evidences of a beginning effect of the corpus luteum hormone. Specimen was stained with hematoxylin and eosin ($\times 37$)

had lasted from 2 to 3 weeks. In addition, slight spotting had been noted on several occasions. Twice in the 6 months preceding her visit to the clinic the menstrual flow had lasted for nearly 4 weeks. Dilatation and curettage had been performed 1 year before we saw her at the clinic, but no evidence of malignant change had been found by microscopic examination. The basal metabolic rate was 0. Biopsy of the endometrium, which was performed 22 days after the first day of the last uterine bleeding, revealed a cystic endometrium which was in an early proliferative phase of the menstrual cycle. The tissue is shown in Figure 1 and the normal appearance of early proliferation is shown in Figure 2.

CASE 2 A woman, aged 27 years, came to the clinic because of irregular and prolonged menstrual flow. She was not married. The first menstrual period had occurred when she was 13 years of age. There always had been a great variation in interval between the menses. The menstruation always had been very profuse. Dilatation and curettage had been performed 3 times but this had not produced any relief. General physical examination and pelvic examination did not reveal any abnormality. The basal metabolic rate was -7. The estrin content of the urine on the 23rd day of a 25 day menstrual cycle was 11 rat units per liter of urine. A test for normal amounts of prolactin in the urine gave negative results on the 24th day of the same cycle. Biopsy of the endometrium was performed on the 23rd day of a 25 day menstrual cycle. Microscopic exam-

ination of the tissue revealed a persistent late proliferative phase of the endometrium which was associated with cystic changes. This tissue is shown in Figure 3 and the normal appearance of the late proliferative phase of the menstrual cycle is shown in Figure 4.

CASE 3 A woman, aged 23 years, came to the clinic because of primary infertility. She had been married 4 years. The menses, which first had occurred at the age of 13 years, always had been irregular and prolonged. The amount of menstrual flow per day had, however, not been excessive. Examination revealed that the left ovary was about 4 by 5 centimeters in size. The basal metabolic rate was +4. The estrin content in the urine on the 30th day of the menstrual cycle was 40 rat units per liter. An estimation of the amount of prolactin in the urine on the 31st day following the last menstrual period failed to reveal any evidence of this hormone in the urine. Transuterine insufflation of the fallopian tubes was performed and the kymographic tracing showed a maximal pressure of 170 millimeters of mercury and a minimal pressure of 120 millimeters of mercury. The uterine cramp which was produced by this procedure and the high pressure necessary to force gas through the fallopian tubes suggested the possibility of muscular resistance. Biopsy of the endometrium was done on the 32nd day of a 34 day menstrual cycle. Microscopic examination of the tissue which was removed revealed an endometrium in the persistent early differentiative phase of the



Fig 7 left Late differentiative phase of the menstrual cycle in a cystic endometrium. This specimen shows complete differentiation. There are 6 to 7 longitudinal glands to the low power field but differentiation is complete. The abnormal feature of this endometrium is the presence of cystic areas existing in an endometrium which histologically shows nearly complete effect of the hormone of the corpus luteum. Specimen was stained with hematoxylin and eosin ($\times 37$).



Fig 8 Late differentiative phase of the menstrual cycle

cycle and cystic changes. This tissue is shown in Figure 5 and the normal early differentiative phase of the menstrual cycle is shown in Figure 6.

CASE 4 A woman, aged 26 years, came to the clinic because of primary infertility. She had been married 3 years. The menses first had appeared when she was 15 years of age. The interval between the menstrual periods always had been 28 days and the duration had been 4 to 5 days. For several months before the patient came to the clinic there had been some decrease in the amount of menstrual flow. Examination revealed that the right ovary was about 3 times the normal size. The basal metabolic rate was -4 . On the 26th day of the menstrual cycle the estrin content of the urine was found to be 10 rat units per liter. The amount is within normal limits for this phase of the menstrual cycle. The urine was tested for an excessive amount of prolactin on the 27th day of the menstrual cycle but the result was negative. Transuterine insufflation of the fallopian tubes revealed a normal hystero-graphic tracing and a maximal pressure of 65 millimeters of mercury. Biopsy of the endometrium was performed on the 26th day of a 28 day menstrual cycle. The tissue was found to be of a late differentiative phase of the menstrual cycle and cystic changes were noted. This tissue is shown in Figure 7 and the normal differentiative phase of the menstrual cycle is shown in Figure 8.

COMMENT

Microscopic examination of 28 specimens of endometrium revealed that cystic changes occurred in all phases of the menstrual cycle

in a normal endometrium. Specimen obtained on the 25th day of a normal menstrual cycle. The average number of longitudinal glands remains 6 to 7 per low power field. The glands are twisted on the longitudinal axis giving in cross section a sea shell appearance. The epithelium lining the glands is fully differentiated. This effect is due to complete action of the hormone of the corpus luteum on the endometrium. The endometrium is approximately 4 millimeters thick. Specimen was stained with hematoxylin and eosin ($\times 37$).

In those endometria in which cystic changes occur in the proliferative phase there is often an accompanying proliferation, so called hyperplasia, of a greater degree than occurs normally. Thus, a polypoid endometrium is usually increased in thickness, although the microscopic picture of the proliferation remains the same. As the differentiative phase appears and increases, this proliferation is less and less noticeable but the cystic changes persist. These microscopic findings seem to correlate with the clinical history. Atypical bleeding was not present in any case in which a well differentiated endometrium was associated with cystic changes. Those tissues in which cystic changes were found in the early differentiative phase were not infrequently associated with atypical uterine bleeding. In cases in which a cystic endometrium was in the late proliferative phase of the menstrual cycle, atypical bleeding was more frequently present. The essential difference in these specimens of the endometrium is the degree of differentiation which must exist because of a difference in the activity of the hormone of the corpus luteum. It has been said that the function of the corpus luteum is on an all or none basis. There is microscopic evi-

dence to the contrary Cystic changes are very common in the endometriums of women at the beginning of the menopause, when the first phase of ovarian failure is commencing Ovarian failure is essentially the same among younger women and should be accompanied by the same microscopic appearance of the endometrium The corpus luteum is a gland of internal secretion No other of the so called endocrine glands has an all or none reaction so far as function is concerned An all or none response is certainly not true of the graafian follicle because all degrees of proliferation can be observed microscopically

SUMMARY

Microscopic study of 278 specimens of endometrium removed with a biopsy curette revealed that in 28 of these specimens cystic changes had occurred These tissues represented all phases of the menstrual cycle from

the early proliferative phase to the late differentiation This cystic change is believed to be the result of failure or deficiency of the function of the corpus luteum The amount of proliferation is dependent on how complete or persistent this failure or deficiency has been

REFERENCES

- 1 BURCH, J C McCLELLAN G C, JOHNSON, C D, and ELLISON, E T The diagnosis and classification of menstrual disorders J Am M Ass, 1937, 108 96-100
- 2 HERRELL, W E and BRODERS, A C Histological studies of endometrium during various phases of menstrual cycle Surg, Gynec & Obst, 1933, 61 751-764
- 3 RANDALL, L M Endometrial biopsy of one hundred and fifty six subjects Proc Staff Meet Mayo Clin, 1936 11 58-59
- 4 SCHROEDER, ROBERT Anatomische Studien zur normalen und pathologischen Physiologie des Menstruationszyklus Arch f Gynaek 1913, 104 27-102
- 5 SHAW, WILFRED A study of irregular uterine hemorrhage J Obst & Gynec Brit Emp, 1929, 36 1-69

PATHOGENESIS OF ANAL FISSURE AND IMPLICATIONS AS TO TREATMENT

PAUL C. BLAISDELL, M.D., F.A.C.S., Pasadena, California

An anal fissure is a lesion of comparatively minor pathological import. But from the clinical point of view, its frequency, its common misdiagnosis, its often inadequate management, with the resultant sum total of extreme discomfort and incessant nagging pain—all combine to make it one of the most important anal lesions. To this every proctologist will attest. To him the typical history of neglect, or ineffectual treatment over weeks and months—of ointments and applications of every kind and description, of brutal dilatations and of various injections and surgery—is a matter of almost daily experience. And the physician who finally secures relief for the patient is indeed the recipient of the latter's genuine gratitude.

Heretofore there has been no fully adequate nor complete statement of pathogenesis concerning this common lesion. There has resulted, as always under such circumstances, a babel of therapeutic suggestions with assurance granted to none that his efforts at cure were along logical and scientific principles. Apparently divergent methods of treatment, presupposing also divergent concepts of pathogenesis or even without any such concept, have occasioned equally satisfactory reports and as positive denunciation. Nearly all procedures have on analysis combined a variety of elements, and no one, by a sound basis of pathogenesis could say which were the effective and which the inert components. The pragmatic test of cure has been misleading both because of these multiple elements and also because of glaring mistakes in criteria of cure.

We wish here to present for the first time a completely adequate conception of pathogenesis which fits in with all the known facts at our disposal which explains the favorable impressions of apparently divergent methods of treatment and crystallizes what has been

the common active element, the recognition of which alone can insure more intelligent treatment. We wish to point out also the mentioned mistakes in criteria of cure, not heretofore discussed.

First, however, a passing word as to diagnosis. All patients with this lesion complain of acute and real anal pain, a history of a few days of such pain is commonly caused by only 3 lesions, viz., acute thrombosed hemorrhoids, acute abscesses, and anal fissures. Differential diagnosis usually involves then only these 3 conditions whenever a patient presents himself with acute anal pain. If symptoms have continued somewhat longer (and this is more commonly the case), past the time when an abscess would have ruptured, and visual examination reveals no thrombosed hemorrhoids, one can be almost sure that an anal fissure is present. And let no one with any sympathy for human suffering undertake exhaustive corroborative examination without at least surface anesthesia!

A good start had been achieved toward a firm pathological basis on which to build a rational therapeutic structure with the observation that these fissures are for the most part found directly posterior in the anal canal, occasionally directly anterior, and only very uncommonly elsewhere around the circumference. It was logical to assume, therefore, that whatever peculiar factor of any nature, anatomical or pathological, or both, could be found commonly posteriorly and to a less extent anteriorly, would provide a satisfactory point of departure. Such a factor was found in the Y shaped divergence of certain of the external sphincter fibers in their course to attach to the coccyx, and, to a less extent anteriorly.

And it should be emphasized, on the other hand, that all pathological lesions such as crypts, hemorrhoids, hypertrophied papillae, and varicosities, which theoretically might

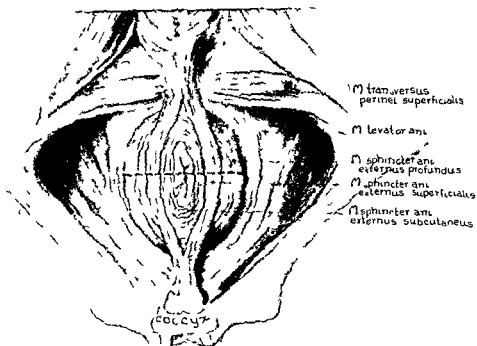


Fig 1 Sphincter muscles of the anus from below. Vertical levels of the various parts are shown in Figure 2. The transverse dotted line is for the purpose of identifying section represented by models. Notice that the subcutaneous and deep portions of the external sphincter are arranged in a circle, while only the superficial portion diverges to anterior and posterior attachments. (After Milligan and Morgan in *The Lancet*.)

cause fissures, are very noticeably inconspicuous directly in the posterior and anterior commissures. It is well known that these pathological entities occur most constantly and invariably at 5, 7, and 11 (referring to the face of a clock) and *not* at 6 and 12 where fissures occur. If fissures are caused by underlying hemorrhoids and varicosities, why are the former *rarely* found where the latter are *constantly* situated? Or if, as is also commonly stated, a fissure is the result of a torn crypt, why are not *other* crypts, commonly found elsewhere around the circumference, also torn? If that be the complete explanation, why are they found torn just anteriorly and posteriorly? No, these explanations are simply inadequate. It is not denied that these other lesions have bearing, and no treatment for fissure should be considered adequate which does not include appropriate treatment for them, but their role is not major.

It is to the peculiar anatomical features, then, rather than to possible concomitant pathological entities, that we must logically turn for further consideration as regards the pathogenesis of anal fissures. The explana-

tion by the Y arrangement of the muscle fibers was put forward by Lockhart-Mummery, as quoted by Gabriel, and is a commonly accepted one, the overlying tissues being assertedly least supported at the commissures by such arrangement. But no treatment ever suggested has attempted to correct this underlying cause if such it be, or achieved such correction, an obviously illogical state of affairs!

One important fact was, and has been, overlooked, in connection with this explanation, and this failure led to loss of the scent and to the pathological groping and resultant divergent therapeutic opinion. Such explanation would inevitably presuppose the resultant fissure to occur directly between the crotches of the Y, as shown by the circle in Figures 2, 4, and 5. If one will examine these cases with this point particularly in mind, disturbing tissue relations as little as possible by means of utmost gentleness, he will find that these fissures do *not* occur *above* the anal intermuscular septum on the tissues overlying the crotch but *further caudad*, as shown by the square in the same figures, on the surface of

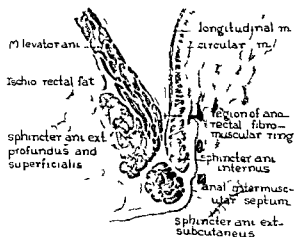


Fig. 2 Vertical section of anal canal. Notice that the subcutaneous portion of the external sphincter is on the same vertical plane with the internal sphincter separated from it by the anal intermuscular septum—a landmark readily identified in the living by palpation—the deep and superficial portions of the external sphincter on the other hand surround the internal sphincter enclosing and supporting it. Black circle and square have been added and are explained in text. (After Milligan and Morgan in *The Lancet*.)

the *subcutaneous* portion of the external sphincter, the fibers of which do not attach to the coccyx, but run circularly all the way around the anus. These fissures occur so near the outlet that they may usually be seen with but very slight, indeed sometimes without any, parting of the anal folds or outward sliding of the skin. Such would not be the case if the fissures occurred higher up on the surface of the internal sphincter which overlies the crotch of the superficial portion of the external sphincter (Fig. 4). Examination under anesthesia reveals that the relation of the fissure to the anal intermuscular septum and subcutaneous portion of the external sphincter can be corroborated by palpation with the finger, for these latter are easily recognizable landmarks.

And yet we believe it impossible to get away from the fact of the Y shaped diverging fibers as an etiological factor. For further consideration—as also for full appreciation of the discussion to this point, a detailed knowledge of anal anatomy is essential. The recent

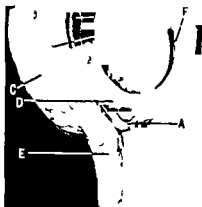


Fig. 3 Model of the sphincter muscles of the anus, representing section below dotted line in Figure 1. Levator ani muscle is not included. Model represents muscles in dilated state. 1 lower border of internal sphincter. 2 small piece of the subcutaneous portion of the external sphincter has been cut away at the upper left to show how this portion and the internal sphincter are on the same vertical plane. 3, superficial portion of the external sphincter with diverging fibers. E attaching to coccyx. C deep portion of external sphincter composed entirely of circular fibers. D subcutaneous portion of external sphincter consisting entirely of circular fibers which do not surround and support the internal sphincter as do the superficial and deep portions, but is on the same vertical plane with it and separated from it by the anal intermuscular septum. F.

paper of Milligan and Morgan is the best practical exposition on this subject of which we know and in our opinion should be thoroughly mastered by all who perform rectal surgery. It is only possible to point out within the limits of this paper that the external sphincter is in reality composed of 3 distinct portions, viz., the deep, the superficial, and the subcutaneous portions (all figures). The deep and superficial portions surround the internal sphincter (which is but the slightly thickened termination of the circular coat of the bowel) like a band, the deep portion merging at its upper border with the levator ani. The deep and subcutaneous portions are composed of circular fibers only, while only the *superficial* portion has Y shaped fibers posteriorly (and to a less extent anteriorly), with attachment to the coccyx. Also to be especially noted is that the subcutaneous portion does not enclose the internal sphincter, as do the other portions, but is caudad to it, on the same longitudinal plane with it, and

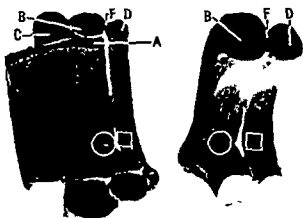


Fig. 4 On left is model shown in Figure 3, looking down on it from above. On right are just segments of the subcutaneous and superficial portions of the external sphincter in same relative position, showing diverging fibers of latter. If these diverging fibers were the sole cause of fissure the latter would be situated as represented by the circle, which occupies the same relative position in both models. Fissures do *not* occur here, however, but are found rather at position marked by the square. Letters represent the same structures as have been described in Figure 3.

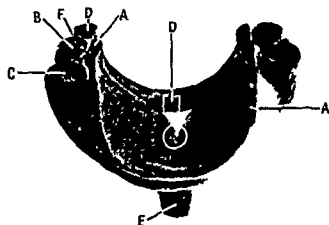


Fig. 5 Same model as Figure 3 representing here a view of the anal canal looking from within out, with muscles in dilated state. The formation of a posterior bar (and to a less extent an anterior bar) by the comparatively weak and comparatively unsupported subcutaneous portion of the external sphincter is plainly shown, and reveals the necessity of including the severance of this bar as a part of the procedure in the treatment of anal fissure. The letters represent the same structures as have been described in Figure 3.

separated from it by the anal intermuscular septum.

Now then, why are fissures found on the surface of the subcutaneous portion? The explanation is found on viewing our models illustrated, and from them hypothecating the behavior of the component elements on dilatation of the anus as during the passage of feces. The situation is shown in Figure 3. The bowel wall including the internal sphincter is well supported at the upper limit of the anal canal by the surrounding deep portion of the external sphincter, strongly supported in turn by the levator ani, further down it is well supported by the surrounding superficial portion of the external sphincter, together, the internal sphincter and surrounding superficial portion of the external sphincter, together with intervening tissue, form a strong support, and posteriorly the elements inside the crotch of the external sphincter follow the shape of the latter as shown. The subcutaneous portion of the external sphincter, now, besides being the smallest of the 3 components of the external sphincter, stands by itself, as can be seen, unaugmented by internal sphincter and other elements within, and with no attachments to the coccyx posteriorly. It must therefore swing across the

crotch as shown—the weakest part of the whole anal ring.

Now let us view the situation from within the rectum, looking outward through the anal canal (Fig 5). The relatively weak and unsupported subcutaneous external sphincter is plainly seen, stretched across like a bar. And both because of its comparative weakness and its uniquely exposed and unsupported position, it constitutes, together with its overlying mucous membrane, the most vulnerable point to injury, during defecation, of the whole anal canal.

If one doubt the existence of this bar, let him examine the anus with this in mind, following the landmarks suggested by Milligan and Morgan. He will feel plainly the anal intermuscular septum, and caudad to it the subcutaneous portion of the external sphincter—all the way around, but more plainly and distinguishably directly posterior, and particularly if the anal canal be put on stretch while withdrawing opposed examining fingers. We have repeatedly asked inexperienced internes assisting us in operating upon these patients to palpate the anal canal on the ball of the flexed forefinger, drawing it slowly from within out, and to compare sensations obtained in the commissures and lateral quad-

rants With no coaching or suggestions whatsoever on our part the posterior subcutaneous bar beneath the fissure is invariably noted except in cases in which particularly profound relaxation is obtained by the anesthetic Even in these latter cases, with the assistance of an indefinite suggestion of such a bar as possibly being present in one of the quadrants, its presence is usually correctly determined posteriorly

The implications as to treatment are obvious Severance of the muscle bar to conform with the Y shape of the more cephalad superficial portion of the external sphincter must theoretically comprise the essential element of treatment, with a light pack of vaseline gauze laid in the wound in the direction of the anal canal for several days to prevent healing of the ends into the old position

The validity of these theoretical considerations has received practical proof in my own experience of several hundred cases We have used exclusively the wedge shaped resection of the ulcer described by Gabriel, with the broad base on the outside of the canal including healthy tissue This base has been dissected rather deeply, its greater width and depth thus affording opportunity for the wound to heal first on the inside At first the muscle was not severed and recurrence of the fissure was so common that we were thus led to the review and study of the situation with this communication as the result Since severing of the muscle bar, recurrence has not been a factor, even with a much less radical dissection than advocated by Gabriel The procedure is not recommended to those who are unable to recognize, at least approximately, the limits of the subcutaneous portion of the external sphincter In all of our experience we have never had a single untoward result from severance of these fibers, but we do not share a commonly expressed confidence in the innocuousness of unlimited posterior proctotomy

Other proctologists of experience, such as Buie (5), for example, have expressed their conviction on the importance of severing muscle fibers, although no accurate description of just what amount should be severed is found Others have opposed this particular

step, while some have mentioned it as rather optional, for heretofore the procedure has been entirely empirical and there has been lacking the rational correlation of an adequate conception of pathogenesis with what was accomplished by severance of the muscle, such complete concept being necessary to make the position impregnable For example, it had been held that such severance "put the muscles at rest" and thus gave chance for healing But wounds following hemorrhoidectomy and other anal surgery do not require the muscles "being put at rest" to heal satisfactorily, nor in the nature of things could the sphincter mechanism be put at rest without its complete severance, and resultant incontinence It is small wonder that the importance of this element of procedure has failed of the universal recognition which this study demonstrates to be deserved

Furthermore, we have already alluded to the possibility of fallacious criteria of cure as having been a factor in failure to achieve universally accepted treatment In this connection we wish to point out that by resection of the fissure alone one can and does very frequently obtain symptomatic relief without actual healing of the fissure This is because of effective interruption of nerve fibers by the resection of tissue and its replacement by insensitive scar tissue Indeed, several of our patients in the past, who failed to return for final examination as directed, since they felt so well, returned later with fistulas which had originated in unhealed or recurrent fissures

Another point to which I wish to call attention is that healing, even though corroborated by vision, is not a sufficient criterion of satisfactory cure These fissures frequently heal without any treatment Indeed, a history of alternating periods of healing and recurrence is typical and characteristic In other words the factor of recurrence and not of healing becomes the real criterion of successful management Permanent healing, corroborated by repeated usual examination, must constitute the only adequate criteria of the efficacy of any treatment of anal fissure It can readily be appreciated how failure to observe these criteria has, in the past, added considerably to confusion

Dilatation of the anus has been commonly advocated as treatment of anal fissure. Repeated dilatations in combination with anesthetic oily solutions is a recent suggestion of Daniels. Here too, the explanation of "rest" has constituted the theoretical background. A more logical explanation is a stretching, first, and most markedly, and thus obliteration of, the weak and prominent bar. There are valid arguments against the method.

We should like to dwell at length on the many misconceptions which are encountered in the literature and are common in practice, but it would take us too far afield. They can in large measure be forgiven, because heretofore, as stated, no entirely adequate thesis of pathogenesis or criteria of cure has been developed and universally accepted. One word, however, concerning a therapeutic measure which has attained extended credence but which fits in with no rational pathological basis, viz., the injection of oily anesthetic solutions beneath the ulcer. By the relief of pain, this is said to relieve spasm of the sphincter long enough to allow the fissure to heal.

Now either the pain of the fissure inaugurates the spasm of the muscle or else the spasm inaugurates the fissure. True, it is possible to have some element of a vicious circle, but one or the other must be the primary and dominant factor. If the fissure be first, and such is logical, then injection of the anesthetic will, by relief of pain, relieve the spasm—just as morphine relieves the rectus spasm of acute appendicitis. But what theoretically conceivable pathological cause of the fissure could thereby be affected, any more than the appendix is removed by the morphine? If, on the other hand, the spasm of the muscle be the primary lesion and the cause of the fissure, then too, relief will continue only until the anesthetic wears off, the pathological basis of the spasm remains

This paper is not intended to serve as a complete guide to the treatment of anal fissure. At best, there is much in experience with these lesions which printed word can scarcely convey. One learns, for example, how necessary is constant postoperative supervision of the wound to prevent bridging instead of healing from the bottom, how carelessness in this respect can in a few days entirely nullify one's most perfect operative efforts, how the base of the wound must be prevented from healing before the apex inside, that scar tissue and other pathological lesions must be removed, and that the edges of the wound must be carefully trimmed. These details and others must forego expression here, for we wished at this time only to clarify by our observations if possible, and emphasize, more general principles.

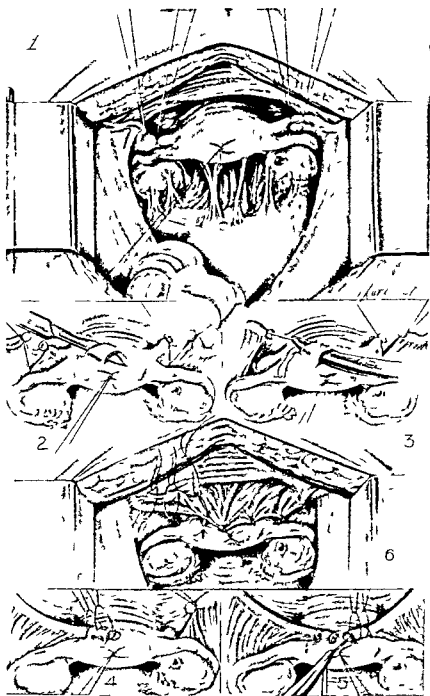
SUMMARY

Lack of an adequate concept of pathogenesis and errors in criteria of cure have retarded agreement on principles of treatment of anal fissure.

Severance of an indefinite portion of the external sphincter has been a disputed point in the treatment of anal fissure, and evidence submitted has been largely empirical. An adequate concept of pathogenesis is presented which lends firm support to the affirmative view, and accurately defines the portion of the sphincter to be severed.

BIBLIOGRAPHY

1. DANIELS, E. A. Anal fissure anal spasm and anal stenosis. *Am J Digest Dis* 1936, 3: 775.
2. GABRIEL, W. B. *The Principles and Practice of Rectal Surgery*. London: H. D. Lewis & Co., Ltd. 1932.
3. HILLER, ROBERT I. The anal sphincter and the pathogenesis of anal fissure and fistula. *Surg., Gynec. & Obst.* 1934, 52: 921.
4. MILLIGAN and MORGAN. Surgical anatomy of the anal canal, with special reference to ano rectal fistulae. *Lancet*, 1934, 2: 1150 and 1223.
5. RANKIN, BARGEN and BUTE, L. S. *The Colon, Rectum and Anus*. Philadelphia and London: W. B. Saunders Co., 1932.



The Tunnel Method for Correction of Uterine Retroversion — J Lyle Cameron

CLINICAL SURGERY

FROM THE GYNECOLOGICAL SERVICE, ROYAL WATERLOO HOSPITAL, LONDON

THE "TUNNEL" METHOD FOR CORRECTION OF UTERINE RETROVERSION

J LYIE CAMERON, M D, F R C S (Eng), London, England

RETROVERSION of the uterus necessitating some form of operative intervention for relief of symptoms is a very common condition and one often encountered during the performance of lower abdominal operations such as appendicectomy. It is, therefore, advantageous for the general surgeon to be familiar with a simple method of dealing with cases of retroversion, and one which can be depended upon to yield satisfactory results.

The operation for correction of retroversion of the uterus about to be described is one which I have employed with uniform success for some years.

With slight modifications in technique the procedure is similar to that devised by Professor van Rooy of Amsterdam whose excellent work I have been privileged to witness.

The *indication* for its employment is retroversion of the uterus associated with backache, dysmenorrhea, dyspareunia, pelvic pain, or a feeling of weight in the pelvis when the patient is standing or walking.

Its *special advantages* are that the fundus of the uterus is tilted forward without lifting the uterus out of the small pelvis which is its normal situation and where mechanical factors may be such as to assist the processes associated with

conception. Furthermore, as van Rooy pointed out, the fallopian tubes are neither linked nor bent as is usually the case when forward suspension of the uterus is effected by operations which entail shortening or tightening of the round ligaments. This bending of the fallopian tubes was thought by van Rooy to be a potent cause of the sterility which frequently follows these round ligament operations.

Contra indications to its use are acute or sub-acute salpingitis, and conditions which firmly fix the uterus in a retroverted position such as extensive inflammatory adhesions or occasionally dense fibrosis associated with endometriosis, especially when the fallopian tubes or ovaries are irreparably damaged and sterility is inevitable. In such circumstances a firmer and stronger fixation of the uterus is imperative.

Procedure. Preparation for abdominal operation is carried out in the usual manner. With the patient in the Trendelenburg position a skin incision 4 to 5 inches long is made in the midline below the umbilicus and with the lower end terminating about 1 inch above the pelvic brim. The opening in the aponeurosis and parietal peritoneum is carried well down to the upper border of the symphysis pubis. The wound edges being covered with mackintosh sheeting and thin towels, are separated with a self retaining re-

Fig 1 The abdomen having been opened and the wound edges retracted, the uterus is drawn upward with a traction stitch through the fundus. Thin strands and tenuous veils of fibrous adhesions are rendered taut and easily divided. Two stitches are passed around each round ligament one $\frac{1}{4}$ inch and one $\frac{1}{2}$ inch from the side of the uterus.

Fig 2 The round ligaments on each side have been divided between the pairs of stitches and an oblique tunnel is now made with a small scalpel or a pair of pointed scissors through the musculature of the front of the uterine body.

Fig 3 A pair of forceps is passed through the tunnel gripping the stitch on the distal portion of the round liga-

ment which is to be drawn through the tunnel to the required distance.

Fig 4 The distal portion of the round ligament is secured in the tunnel by two stitches the redundant portion having been removed.

Fig 5 The round ligament on the opposite side is drawn through the tunnel similar to that previously made and secured in place with stitches.

Fig 6 A fold of peritoneum along the line of its loose reflection from the front of the uterus on to the bladder has now been lifted up and stitched into place so as to cover the tunnels and all needle punctures in the front of the uterus. No opening is left through which bowel or omentum may obtrude.

tractor, and the towels and mackintosh sheets are then well drawn into the upper and lower angles of the incision. Intestine, omentum, and sigmoid colon are gently lifted up out of the pelvis and allowed to fall above the sacral promontory. The abdominal cavity is excluded with a large soft turkish towel rung out of warm saline. When careful exploration has been made, the condition of the pelvic organs has been ascertained and thin strands or tenuous veils of fibrous adhesions have been divided. The uterus is drawn forward and upward with a traction suture through the front of the fundus (Fig 1). Two sutures are passed around each round ligament one about $\frac{1}{4}$ inch and the other about $\frac{1}{2}$ inch from the uterus (Fig 1), the round ligament between each pair of sutures then being divided (Fig 2). Any bleeding vessels are secured with clamps and ligatures or with small mattress sutures of fine catgut as the distal portion of each round ligament is freed for about 1 inch (Fig 2). A tunnel about $1\frac{1}{4}$ inches long is now made through the musculature of the front of the corpus uteri with a small scalpel or pair of pointed scissors (Fig 2). The direction of the tunnel is estimated by pulling the uterus into the desired position and drawing the freed distal end of the fallopian tube into the situation which it will ultimately occupy. The outer end of the tunnel is made medially to the uterine vessels and the inner end emerges on the front of the uterus about $\frac{1}{4}$ inch lateral to the midline and about $\frac{1}{2}$ inch below the highest point of the fundus. A pair of forceps is now passed through this tunnel, securing the stitch on the distal portion of the round ligament

which is drawn through the tunnel (Fig 3) and secured with two, or if found necessary three, interrupted sutures of chromicized catgut (Fig 4).

This process is now repeated on the opposite side (Fig 5).

Each round ligament is drawn through the corresponding tunnel sufficiently far to obtain the desired degree of forward version of the uterus, and the redundant portion is removed.

Hemorrhage from needle punctures is arrested with fine mattress sutures of chromicized catgut on an eyeless intestinal needle.

The area in front of the uterus where the tunnels have been made and which has been pierced by many sutures is now covered to prevent the possibility of bowel or omentum becoming adherent. A fold of the peritoneum along the line of its loose reflection from the front of the lower uterine segment on to the bladder is lifted up and sutured to the front of the fundus uteri with several interrupted catgut sutures (Fig 6) which secure it in place and occlude any opening through which a coil of bowel or a tongue of omentum might obtrude. In securing this fold of peritoneum care must be taken to avoid puncturing the uterine vessels or piercing or bending the fallopian tubes.

When there is associated prolapse of the ovaries these may be suspended near the uterine cornua by pleating each ovario-uterine ligament with a stitch of catgut.

Clots are removed, the pelvis is dried with gauze mops and the abdomen is closed in three layers.

RESECTION OF HEAD OF PANCREAS AND DUODENUM FOR CARCINOMA—PANCREATODUODENECTOMY

ALEXANDER BRUNSCHWIG, M D, F A C S, Chicago, Illinois

PARTIAL or subtotal pancreatectomy has been performed for benign and malignant neoplasms and for hyperinsulinism (2). In a recent publication, Whipple, Parsons and Mullins (4) have again shown the feasibility of removal of segments of duodenum and portions of the head of the pancreas for carcinoma of the ampulla of Vater or lower portions of the common bile duct. As far as the writer has been able to determine, wide resection of the head of the pancreas together with practically all of the duodenum for carcinoma of the head of the pancreas has not been recorded. Such an operation was recently performed by the author and appears to be a feasible procedure. The history of the patient and details of operative technique are as follows:

H P No 166635, male, aged 69 years, was admitted to the medical service (Dr George F. Dick) January 5, 1937 complaining of more or less constant pain in upper right quadrant of the abdomen radiating through to the back and to the left of 8 weeks' duration, not aggravated by eating, increasing icterus and marked general pruritus of 7 weeks' duration, and difficulty in urination, 2 years. There had not been an appreciable weight loss. Physical examination revealed a thin white male, markedly icteric. A rounded indefinite mass was palpable in the region of the fundus of the gall bladder. Temperature was normal. The Wassermann and Kahn reactions were negative, red blood count, 4.3 million, white blood count, 5,400, hemoglobin, 90 per cent. Urinalysis revealed albumin, negative, sugar, negative, bile, + + + +, icteric index, 119, the stools were clay colored. Roentgenographic examination of the chest and fluoroscopic examination of the esophagus and stomach were negative, questionable deformity of the duodenal bulb. Cholecystograms were made but the gall bladder could not be visualized after oral administration of dye.

Clinical diagnosis: Carcinoma of the head of the pancreas with common duct obstruction.

Operation—first stage, January 8, 1937. Spinal anesthesia was used with ethylene toward the end.

In view of the pre operative diagnosis it was planned to do a cholecystogastrostomy as a palliative procedure. The abdomen was entered through a high midline incision. No excess free fluid was present. Palpation in the region of the head of the pancreas revealed a very firm mass about 4 centimeters in diameter adherent to the adjacent inner wall of the descending portion of the duodenum. Palpation and inspection of the liver showed no evidence of metastases. The gall bladder was markedly distended by bile its wall was thin and there were no stones. Palpation and inspection of the peritoneal cavity and the viscera like-

wise showed no evidence of metastases. A finger could be inserted into the foramen of Winslow. Because the firm head of the pancreas was movable upon the underlying tissues it was decided to attempt resection of it by a two stage operation based upon the principles emphasized by Whipple.

At Dr. Phemister's suggestion the following steps of the first stage were performed: (1) "short loop" posterior gastro enterostomy with 2 rows of continuous linen sutures, (2) cholecystojejunostomy with interrupted silk sutures at a point approximately 12 inches below the above—the loop of jejunum was brought through an opening made in the right portion of the transverse mesocolon, the margins of the rent being sutured to the small bowel passing through it, (3) an entero enterostomy below the passage of the jejunal loop through the mesocolon. The several procedures are indicated in Figure 1. It was thus possible for bile to pass into the jejunum and the entero enterostomy permitted passage of material down the jejunum from the stomach without circulating past the gall bladder. Furthermore, the exposure for the second stage was facilitated by not having the gall bladder anastomosed to the stomach over the region of the pancreas.

Recovery from this operation was uneventful and patient was discharged January 27, 1937, for a rest period at home. On February 5, 1937, he was readmitted. The icterus had improved considerably, icteric index, 29. A glucose tolerance test performed on February 8 showed starting blood sugar 140 milligrams per cent and 291 milligrams per cent after 3 hours, with + + + reduction of urine. A second test performed a week after the second operation showed starvation blood sugar to be 107 milligrams per cent, $\frac{1}{2}$ hour 183 milligrams per cent, 2 hours, 179 milligrams per cent and 3 hours 151 milligrams per cent. Urine was negative. There is no apparent explanation for the high values obtained in the first test.

Second stage was done February 11, 1937. Under ethylene anesthesia the abdomen was reopened through the old incision. The peritoneal surfaces appeared smooth and glistening but slightly fibrotic. There were no evidences of peritoneal metastases but the lower abdomen was not explored. The liver appeared free from metastases on both inspection and palpation. A curved incision was made through the peritoneum following the right lateral border of the descending portion of the duodenum and this loop with enclosed head of the pancreas was elevated to the left by gauze dissection. This permitted satisfactory palpation of the lesion which did not appear to have increased appreciably in size since the first operation. It was also possible to ascertain that the growth had not apparently infiltrated into the retroperitoneal tissues.

The stomach at the pyloric sphincter was divided between two clamps and the first portion of the duodenum was retracted to the right. This exposed the midportion of the common bile duct which appeared to be about the size of a lead pencil. It was divided between clamps and the upper end doubly ligated with linen.

The neck of the pancreas was palpated and beneath it a curved grooved director was carefully inserted from above downward and to the left, its tip emerging over the terminal

From the Department of Surgery and the Division of Roentgenology of the Department of Medicine of The University of Chicago.

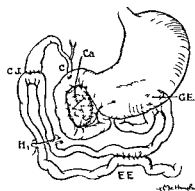


Fig 1

Fig 1 First stage Ca Carcinoma in head of pancreas C common duct CJ cholecystojejunostomy HE transverse mesocolon through which loop of jejunum is passed for above anastomosis GE short loop posterior gastroenterostomy EE entero-enterostomy The figure is diagrammatic in that the loop of jejunum employed for anastomosis with the gall bladder is not as long as shown and the entero-enterostomy was performed a short distance below the opening in the transverse mesocolon

Fig 2 Second stage performed a month later Inc curved incision through posterior parietal peritoneum along convex border of duodenum to permit mobilization of head of pancreas Division of pyloric sphincter C

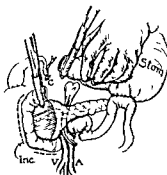


Fig 2

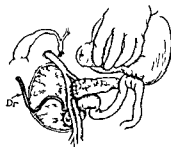


Fig 3

Ligated common duct Curved grooved director is passed beneath neck of pancreas and over superior mesenteric vein V and I artery Neck of pancreas is transected over grooved director

Fig 3 Termination of operation Excision of the head of the pancreas and duodenum for carcinoma The practically complete removal of duodenum and head of pancreas The stomach and duodenal stump are invaginated the cut surface of the pancreas ligated with mattress sutures Dr soft rubber drain to large denuded retro peritoneal space Superior mesenteric vein is seen coursing upward to join splenic vein in formation of the portal vein

portion of the duodenum (Fig 2) The neck of the pancreas was then divided the scalpel coming down upon the grooved director When the parenchyma had been partially severed several cubic centimeters of clear slightly viscous fluid escaped This was pancreatic secretion dammed up in the dilated pancreatic duct When division of the neck of the pancreas was completed it was found that this had occurred just over the superior mesenteric vessels as they coursed downward over the terminal duodenum The head of the pancreas and adherent duodenum were then retracted downward and to the right and removed after the latter was divided between clamps just beneath the superior mesenteric vein The pyloric stump of the stomach was invaginated by 3 layers of interrupted linen sutures the duodenal stump by 2 layers of similar sutures The freshly cut surface of pancreas was ligated by 4 interrupted and interlocking linen mattress sutures the pancreatic duct was ligated separately A large space previously occupied by duodenum and head of pancreas remained (Fig 3) This was drained by a small soft rubber tube and the midline incision closed

Pathological study The specimen consists of what appears to be practically the entire duodenum surrounding the head of the pancreas the latter consisting for the most part of a firm mass that is inseparable from the adjacent duodenal wall In the fixed (formalin) state the duodenum measures 18 centimeters in length and the head of the pancreas 5 by 4 centimeters The cut surface of the neck of the pancreas does not grossly exhibit tumor tissue The pancreatic duct is identified but a probe cannot be passed through it into the duodenum The severed common duct is identified and a probe passes readily into the duodenum The specimen is bisected as shown in the accompanying Figure 4 The plane of bisection does not include the plane of division of the neck of the pancreas from the body which was not removed at operation The carcinoma arising in the head of the pancreas has extensively in-

filtrated the duodenal wall producing at one point a small ulceration in the duodenal mucosa. The ampulla of Vater is not involved in the growth Two small firm discrete lymph nodes are removed from the serosal surface of the third part of the duodenum

Microscopic examination of a large section through the lesion and adjacent duodenal wall shows a duct cell carcinoma composed of large columnar malignant epithelial cells forming solid cords and tubules. These cell masses can be seen streaming into the duodenal wall between muscle bundles Sections through the lymph nodes show metastatic carcinoma Sections through a fragment of pancreas removed from the line of resection show scattered clumps of carcinoma cells There is also marked fibrosis between clumps of alveoli diffuse round cell infiltration and proliferation of small pancreatic ducts.

Postoperative course Immediate recovery from the second stage was uneventful there being a minimal temperature reaction and no nausea or vomiting The small drain was removed on the fifth day A small amount of clear serous drainage persisted from the drain site in the wound and on the fourteenth day it became distinctly bilious in appearance and increased in quantity The wound otherwise healed *per primam* A small Pezzer catheter was inserted into the sinus and connected with a Wangenstein suction apparatus The daily fluid loss was tabulated and reached a maximum of 560 cubic centimeters on the forty fourth day after which it decreased rapidly in a few days to approximately 50 cubic centimeters a day and changed from a bilious character to a whitish mucoid discharge containing at intervals recognizable food particles This fluid was not found to contain active proteolytic enzymes It was thought at first that the ligated common duct had reopened but the change in character of the drainage indicated it was an intestinal fistula Repeated attempts to cause the fistula to heal were made by insertion into it of kaolin and zinc oxide pastes but these pro-



Fig 4 Surgical specimen showing excised duodenum and enclosed head of pancreas which contained a duct cell carcinoma that had extensively infiltrated the adjacent duodenal wall. A probe has been passed through the ampulla of Vater, upward into the excised segment of common duct. These structures were not grossly involved by neoplasm. The plane of bisection of the specimen does not include the transected neck of the pancreas which did not grossly exhibit invasion by carcinoma.

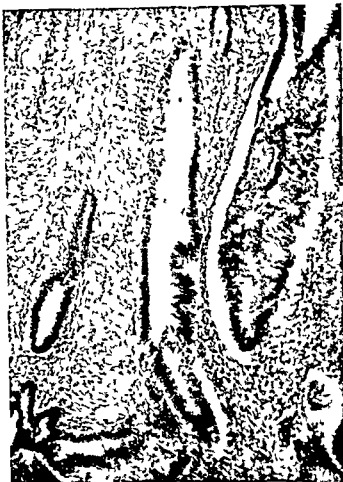


Fig 5 Photomicrograph showing growth of duct cell carcinoma of head of pancreas infiltrating duodenal wall $\times 80$.

cedures did not entirely succeed although the fistula was reduced to about 2 millimeters in diameter when the catheter was not in place. Because of difficulty in starting the stream, an inlying urethral catheter was inserted following the operation. On the twentieth day a transurethral prostatic resection was performed by Dr C B Huggins of the Division of Urology following which practically normal urination was possible.

In spite of the complications noted the patient's condition remained generally fair. A full diet was permitted after the twelfth day and although his lack of appetite for sufficient quantities necessitated frequent hypodermoclyses of 5 per cent glucose, adequate amounts of fluid were taken by mouth.

After the third week the patient sat up in bed or got out of bed, walked a little and sat up in a wheel chair for varying periods almost every day. The severe pruritus subsided and the icterus had disappeared by the end of the third week when the icteric index was 13. The stools were always light in color and pasty in consistency but contained bile. This was due to absence of external pancreatic secretion. The urine tested at intervals, showed no reduction at any time.

On April 26, 1937, the patient's condition suddenly appeared worse in that there was complete lack of any desire to eat, marked dizziness when he attempted to arise or sit up in bed and pronounced asthenia. The blood pressure did not fall. The following day the sclera became

rapidly yellow and bile appeared in the urine. There were no chills or rise in temperature. On April 30, 1937, the patient went into coma and died this being the eighty-fifth day following the second stage of the operation. Urinalysis was negative, blood chlorides 445 milligrams per cent and non protein nitrogen 47, all taken a few hours before death.

Summary of principal necropsy findings. Carcinomatosis of the peritoneum with ascites (2000 cubic centimeters). Multiple large metastases throughout the liver, a small fistula leading from the inverted duodenal stump (of which section of bowel there remained about 15 inches) to the midportion of the healed operative wound. The closed portion of common bile duct contained yellow mucoid material. The site of the duodenum and head of the pancreas contained inspissated material undoubtedly derived from the fistula on the one hand and as a result of injections of kaolin and zinc oxide pastes through the skin opening in endeavor to close the fistula. However this space had become much reduced in size as compared to its extent at the second stage of the operation and was well walled off from the general peritoneal cavity. Sections of surrounding granulation tissue showed numerous masses of carcinoma cells. No peritonitis and no inflammation or ulceration in the stomach and intestines were noted. The anastomoses were healed and functioning. Sections of the liver showed moderate polynuclear and round cell infiltration about the small hepatic ducts and scattered small abscesses in the

parenchyma. The liver cells exhibited no marked changes in the routine sections nor in the sections stained by scharlach R. No terminal pneumonia was present.

The cause of death was widespread and rapid development of secondary growths in the form of peritoneal carcinomatosis extensive hepatic metastases and the latter, as well as perhaps the cholecystenterostomy contributing to a diffuse cholangitis. The survival period of almost 3 months in this case with no obvious marked metabolic disturbances due to the nature of the operation constitutes evidence for the feasibility of this type of operation in dealing with malignant neoplasms such as described above.

Total extirpation of the duodenum was for a time thought by physiologists to be incompatible with life. This impression together with the relative infrequency of operable tumors of the duodenum or head of pancreas, and the feeling that total extirpation of the head of the pancreas and duodenum was technically very difficult, no doubt contributed to the general lack of interest on the part of surgeons in these types of operations. However, as long ago as 1918 Lester R. Dragstedt and associates first demonstrated that in the dog the duodenum was not indispensable to life and that this segment of bowel did not have special internal or external secretions necessary for the function of the intestines lower down as was held at that time by some investigators.

SUMMARY

A case history is presented to show the feasibility of excision of the entire head of the pancreas and practically all of the duodenum for carcinoma of the head of the pancreas. Such an operation might also be performed for primary malignant tumors of the duodenum.

While no gross evidence of metastases was present at the time of the operations, the patient died 85 days following excision and, at necropsy, carcinomatosis of the peritoneal cavity and multiple liver metastases were found. Gross and histological examination of the liver, stomach, and small bowel revealed no evidence that the removal of practically the entire duodenum had resulted in significant metabolic disturbances during the patient's survival period.

REFERENCES

1. DRAGSTEDT L. R. DRAGSTEDT C. L. McCLESTOCK J. T. and CHASE C. S. *Am. J. Physiol.* 1918 46: 584.
2. McCALGHAN J. M. and BROWN G. O. *Ann. Surg.* 1931, 103: 354.
3. WHIPPLE A. O. and FRANTZ V. K. *Ann. Surg.* 1931, 101: 1299.
4. WHIPPLE A. O. PARSONS W. B. and MELLIN C. R. *Ann. Surg.* 1933, 102: 63.

THE TREATMENT OF ACUTE EMPYEMA

J MURRAY BEARDSLEY, M D, Providence, Rhode Island

IN the treatment of any type of empyema the two main factors that must be considered are disinfection of the pleural cavity and re-expansion of the lung. The first of these is accomplished by properly placed drainage and irrigation, the latter, by exercises encouraging enforced expiration and measures which tend to lower the pressure within the empyema cavity. In the successfully treated patient these two factors occur simultaneously. Drainage and irrigation attenuate the infection and at the same time the lung gradually re-expands until the pleural space is finally obliterated. Not infrequently this re-expansion occurs so slowly that although the danger to life for the time may be passed, a prolonged low grade infection causes either a delayed convalescence or results in a thickened, rigid, chronic empyema cavity.

In the usual case of encapsulated empyema without bronchial fistula, open drainage following rib resection will usually suffice, provided aspiration treatment has not been prolonged beyond the point of usefulness. It is not always possible to decide at the onset which type of treatment will be the most efficacious but a sufficient number of cases of delayed healing have occurred with open drainage to stimulate many surgeons to use some form of closed drainage so that the advantages of suction can be utilized.

When drainage is carried out by means of a single tube entering the chest, one of two things may be accomplished. If fluid is allowed to run into the pleural cavity we irrigate the cavity but at the same time the intrapleural pressure is rendered positive. If we create suction in the tube and thus encourage drainage and lung re-expansion we are for the time neglecting the part played by irrigation.

With these thoughts in mind we have designed a tube which can at the outset be used for either open or closed drainage regardless of whether rib resection has been done and with which alternate open and closed drainage can be accomplished in a single case at any time if the indication appears to exist. If closed drainage is used both irrigation and suction are achieved simultaneously.

Description of tube The tube is made entirely of rubber and may be boiled again and used several times. It consists of a double tube with an external guard which when in place is flush with

the external chest wall and covers the incision. Each end of the guard is prolonged to form a strap which, when run through a button hole cut in adhesive tape or through a buckle, holds the tube firmly in place. There is a thin rubber diaphragm on the flutter valve principle which may be used with open drainage to encourage re-expansion. This latter idea is not new but the fact that the diaphragm is built into the tube has made it much more efficient than when a piece of rubber dam is used for the same purpose.

Open drainage It is possible to carry out open drainage through an intercostal stab wound but when the pus is thick and filled with organized exudate, rib resection is usually desirable to break up pockets and remove fibrin. If a stab wound is used thorough irrigation and suction of the cavity should be done in the operating room before inserting the tube. When a rib is resected the wound is closed with silk leaving a small opening for the insertion of the tube. The rubber guard covers the incision, the under surface of which is coated with flexible collodion or some other substance that will act as a skin protection. The tube is held in place by its straps as described.

This tube appears to have certain advantages when used simply for open drainage. There is no adhesive strapping in the vicinity of the wound to become saturated with pus and the dressing itself is quickly and easily changed—the gauze is laid over the tube opening and held in place with adhesive or a binder. One of the chief advantages is that the patient can lie upon the affected side and greatly facilitate drainage, since there is no tube protruding from the chest wall. Irrigation is easily carried out without removing the tube either by inserting a bulb syringe tip into one of the openings or by using a catheter.

Closed drainage If it is desirable to change from open to closed drainage or to institute closed drainage at the outset, two tightly fitting catheters which are first swabbed with collodion are drawn through the tube openings. The tube is then inserted into the chest and fixed in the usual manner. To insure an air tight system it is essential that the rubber guard be held firmly against the chest wall. This is accomplished by the use of sponge rubber about 1 inch in thickness and bevelled at the edges which is applied over the guard after a central opening has been cut out

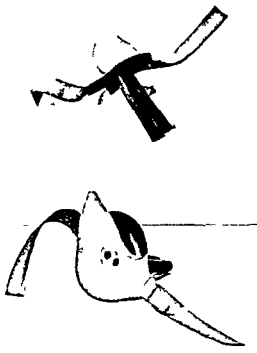


Fig 1 Photograph of empyema tube The mirror view shows the posterior surface which enters the chest

to allow for the catheters. This is held in place by several 2 inch strips of adhesive tape. The periphery of the sponge should extend beyond the edge of the guard about 1 inch. One catheter is now connected with the irrigating bottle and the other to the drainage tube.

Description of suction irrigation system. The flow of solution is started from an open bottle *A*, the rate of flow being controlled by a Murphy drip, the opening in which is sealed with adhesive to exclude atmospheric pressure at this point. One catheter in the empyema tube allows for irrigation, the other for drainage. The solution flows into the chest cavity and out through the drainage tube to the collecting bottle *B*. The solution is first allowed to run rapidly in order to fill up the system and to cleanse the cavity. In the usual case the return flow becomes clear in a short time and with the filling of the system the negative pressure is established. The rate of flow is then cut down to about 60 drops per minute.

A consideration of the drainage tube will show the origin of the negative pressure. Drop 1 at the end of the tube, which should never become submerged, is acted upon by gravity and it is free to fall as soon as it has drawn drop 2 down to take its place. Drop 2 in order to move must draw



Fig 2 Photograph of empyema tube in place. At this time the patient was being treated by the open drainage method. The flutter valve is being held up to show the tube openings.

down drop 3. Thus, force of gravity acting on drop 1 is transmitted through the column and through the drainage tube to the chest. The theoretical value of this force is found by measuring the vertical distance from the entrance of the tube into the chest, which represents the level of fluid, and the exit end of the drainage tube. For example, a vertical distance of 15 inches represents a negative chest pressure of -15 inches of water. For all practical purposes we may assume that this is true and thus eliminate the necessity of using a manometer to check the pressure. In arranging the setup the drainage tube from the chest should drop rather sharply to the drainage bottle and not be carried along for a distance horizontally before entering the bottle, because in this case the negative pressure in the chest would be less than the vertical distance referred to, since part of the force would be exerted in overcoming the resistance to flow in the drainage line. If one feels that it is necessary to insert a manometer it should be incorporated into the system at the same vertical level as that of the fluid in the chest. It will be seen that with the pressure in the chest varying directly with the distance between the fluid level in the chest and the exit of the drainage tube change of the position of the patient would alter this pressure. We do not believe that this factor is of any great importance but have obviated it by having the drainage tube enter a larger tube so as to allow it to slide up or down with any motion on the part of the patient. With this system of closed drainage no airtight bottles or suction apparatus is required. The degree of negative pressure is easily controlled and changeable at any time by raising or lowering

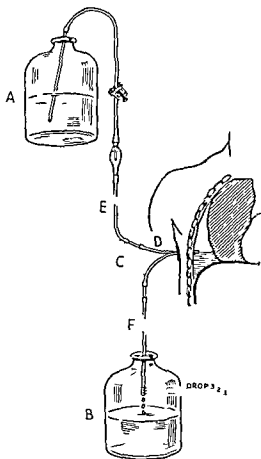


Fig 3 Diagram illustrating the continuous suction irrigation system of closed drainage

the drainage tube. The required negative pressure will vary from day to day, depending upon the progress of the patient and the rate at which the lung is expanding. Likewise the rate of flow may be altered but in our experience 60 drops per minute is adequate after the drainage becomes clear. If one wishes to maintain a negative pressure and omit irrigation, a tube *C* may be incorporated into the system. Then by closing off tube *D*, the fluid runs from *E* to *F*, and the same principles of pressure apply, the only difference being that the chest is not irrigated.

For irrigation to be most effective the entire surface of the infected cavity should come in contact with the irrigating solution. We therefore cut the two limbs of the tube at varying lengths, so that the tube holding the irrigating catheter will enter the cavity an inch or more while the one for drainage is cut so that it does not extend beyond the internal surface of the chest for more than half an inch. When one wishes to flush the entire cavity, the patient is made to lie upon the sound side when the fluid level will rise to the exit of the proximal end of the drainage tube.

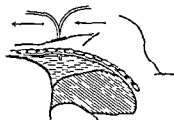


Fig 4 Diagram illustrating the method by which the empyema cavity may be flushed

This tube has been used in 1 case of streptococcus empyema, 1 case of severe mixed infection following the rupture of a bronchiectatic cavity, as well as in cases of pneumococcus empyema. In the first 2 patients mentioned, aspiration treatment had been carried out for a considerable period of time and when suction-irrigation was initiated there existed a complete lung collapse with mediastinal herniation to add to the problem of infection. In every case the results have been satisfactory both from a technical and clinical standpoint, and we believe that the convalescent period has been very definitely shortened.

We believe that as a rule no patient should be discharged from the hospital until the lung has completely expanded, and many patients with empyema, although progressing reasonably well, obliterate their space very slowly. Such patients should have the benefit of some form of suction-irrigation treatment, which in the past we have found difficult to do following rib resection. In our experience the situation has been considerably simplified with this ability to change from open to closed drainage and at the same time keep the empyema cavity clean with constant irrigation.

SUMMARY

- 1 A new empyema tube is described which may be used for either open or closed drainage.
- 2 A system of closed drainage is suggested which would appear to have the following advantages:
 - a No closed bottles or any form of suction apparatus are required.
 - b Irrigation and suction are accomplished simultaneously.
 - c With the employment of this tube closed drainage may be carried out after rib resection.

The author wishes to express his appreciation to Mr John Howe who assisted him with experimental work, and to Mr Franklin Springer of the Davol Rubber Company who supplied, and assisted with the design of, the empyema tubes.

SIMPLIFIED PROCEDURE FOR THYROID EXPOSURE

CHARLES GORDON HEYD, B A, M D I A C S, New York, New York

THYROID surgery is facilitated and precision of technical procedures is obtained by the utilization of three important aids (1) the position of the patient on the operating table, (2) the control of hemorrhage, and (3) the complete exposure of the whole of the operative area

The technical procedures for subtotal resection of the thyroid have become standardized and most surgeons divide the ribbon muscles on each side of the median line to obtain adequate exposure of the thyroid gland. The space between the hyoid bone and the sternum is occupied by the so-called ribbon muscles—the superficial group consisting of the sternohyoid and omohyoid and beneath these a broader and shorter muscle—the sternothyroid. The usual procedure is to incise the cervical fascia in the median line and then to divide the ribbon muscles on each side between the upper and middle third. When this procedure is completed, by retraction upward and downward of the divided muscle groups and lateral traction on the sternomastoid on either side, full and ample exposure is obtained. In the course of our thyroid experience this bilateral procedure has been simplified by dividing both lateral groups of the ribbon muscles between two clamps thus giving an even larger and more ample exposure and making the operative field less encumbered by two clamps rather than by four. A superficial search through standard textbooks on surgery and a cursory review of recent technical literature does not depict this procedure but its simplicity must have suggested itself to other surgeons. Its application in thyroid surgery may be described as follows. With the patient in a semi sitting position the shoulders resting on a sand bag the head extended, the entire field of the neck is draped and the usual partially curved thyroid incision is made, with a slight concavity upward. The skin and subcutaneous fat are dissected upward on the upper flap and to a less extent downward on the lower flap until the platysma and subjacent muscles of the neck are brought fully into view. No attempt is made to divide the platysma myoides as such, nor to leave it attached to the upper or lower skin flaps. With the surgeon standing on the right side of the patient, the

superficial cervical fascia is divided for approximately 7 centimeters along the anterior border of the right sternomastoid muscle. A Parker retractor with lateral traction pulls the fleshy body of the sternomastoid muscle outward exposing the pretracheal fascia as it moves forward from the parotid sheath. The upper belly of the omohyoid muscles will be plainly visible, transverse this space from the hyoid bone downward and outward toward the scapula. The omohyoid is usually retracted upward and the pretracheal fascia incised more or less paralleling the incision along the anterior border of the right sternomastoid. The sternothyroid muscle is readily identified and its lateral edge picked up with thumb forceps. The index finger of the left hand can then be insinuated beneath the three ribbon muscles on the right side with the palmar surface of the finger passing anteriorly over the thyroid gland. The finger passes readily beyond to the median line under the left group of ribbon muscles. The index finger is then turned so that the palmar surface is turned upward and the same incisions are made on the left side at the anterior border of the sternomastoid muscle (Fig. 1). The index finger of the right hand is inserted into the cleft thus made so that there is underneath both groups of ribbon muscles—the left and right—the index finger of the left hand and the index finger of the right hand. The muscles are raised off the isthmus of the thyroid and two Kocher clamps are inserted by the first assistant, one paralleling the left index finger, with the handle of the clamp on the right side of the patient, and the second clamp paralleling the index finger of the right hand and the handle of the clamp on the left side of the patient. These two clamps are applied at approximately the junction of the upper and middle third of the muscle group (Fig. 2). The muscles are then divided and, with a hook retractor placed under each clamp, traction is made upward and downward, and the entire thyroid area is fully exposed (Fig. 3). At the termination of the resection of the thyroid, the retractors are removed and the muscle groups approximated and united by three interrupted sutures of No. 1 chromic catgut (Fig. 4). A latex drain is placed in each thyroid fossa and brought out at approximately the midpoint of the sternomastoid muscles. The lateral incisions on each side are approxi-

From the Department of Surgery, New York Post Graduate Medical School and Hospital, Columbia University

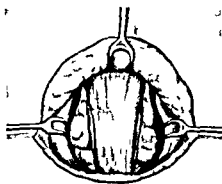


Fig 1

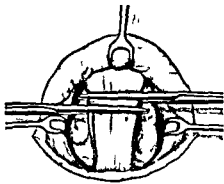


Fig 2

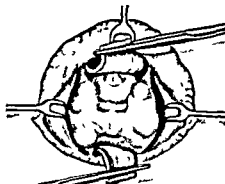


Fig 3

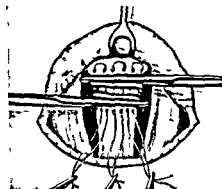


Fig 4

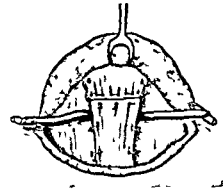


Fig 5



Fig 6

Fig 1 The skin flaps have been retracted and the ribbon muscles divided on each side to their attachment to the sternocleidomastoid muscle

Fig 2 The ribbon muscles on both sides are divided transversely at junction of upper and middle third

Fig 3 The ribbon muscles as a single musculofascial sheet are retracted upward and downward thus exposing the entire thyroid gland

Fig 4 The ribbon muscles are united by means of three interrupted mattress sutures of No. 1 chromic catgut

Fig 5 The musculofascial group of ribbon muscles are united on each side to the sternocleidomastoid muscles, after the insertion of a drain on each side

Fig 6 The drains emerge laterally and the skin is united with Michel clips

mated with interrupted sutures of No. 1 chromic catgut (Fig 5)

The remainder of the operation consists only of the skin closure with Michel clips and the emergence of a drain on each side near the outer extremity of the skin incision (Fig 6). The procedure outlined (1) has provided a more ample exposure than heretofore, (2) has lessened the number of clamps in the operative area, (3) has lessened the actual technical time of the opera-

tion, and (4) healing and subsequent course of the thyroid wound has been expedited. Serum collection beneath the skin has been less frequent and the return of the normal contour of the neck has, in our opinion, been hastened.

No claim of originality is made for this procedure and our only purpose is to give emphasis to an operative procedure that facilitates exposure and as well lessens technical difficulties in thyroid surgery.

BUMPER AND FENDER FRACTURES

FREDERICK G DYAS, M D, F A C S, and MORRIS L. GOREN, B S, M S, M D
Chicago, Illinois

FRACTURES about the knee joint are not rare. Within recent years, however, they have been brought into prominence largely through the increased use of the automobile as a mode of transportation and the application of the roentgenogram in making a diagnosis.

Only 7 years ago F. J. Cotton and Richard Berg gave this type of fracture its name—bumper fracture. They define a bumper fracture as a crushing injury produced by abduction of the leg forcibly enough to smash the external tuberosity of the tibia against the fulcrum of the lateral condyle of the femur. This is the classical type of bumper fracture. Due to the increased speed of the automobile and the attempt to increase the riding comfort the height of the automobile chassis from the ground has been lowered. The bumpers and fenders have also descended to a lower level. The fact explains the recent types of bumper fractures, not at the level of the knee joint but $1\frac{1}{2}$ to 2 inches below or even lower.

From the female fracture ward of Cook County Hospital
Dr. Goren, fracture resident, Cook County Hospital.

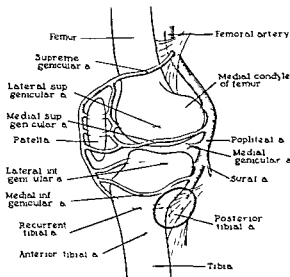


Fig. 1. Drawing of the circulation about the knee joint. The heavy oval shows the most dangerous area for involvement of the circulation of the leg. Injury of the vessels in this area leaves no channel for collateral anastomoses and gangrene may frequently result. (Modified from Callender.)

The newer type of bumper fracture has added the hazard of nerve and blood vessel involvement, which is more frequent than formerly.

Within the past 6 months 4 cases of gangrene of the lower extremity were observed in the fracture wards of the Cook County Hospital—1 case in a child with a fracture of the middle third of the femur, another in an adult male of 47, and 2 in adult females. Three of these 4 cases developed cyanosis, coldness, and blebs characteristic of moist gangrene of the foot. These blebs became infected and required amputation of the leg. The other patient developed a dry gangrene of the distal end of the foot, requiring amputation of the toes.

PATHOLOGICAL ANATOMY

Harold G. Lee in his article on fractures of the tuberosities of the tibia, cites the studies of the architectural structure of the upper end of the tibia made by Barbellion, who has shown that the direction of the fracture line is determined in general by the disposition of the trabeculae making up the bony tissue. In a sagittal section these trabeculae are separated into two systems, an anterior and a posterior which cross each other in arch formation. The anterior and posterior trabeculae located lower down finish on the opposite faces of the bone, while the higher ones terminate on the articular surface itself. Barbellion has shown (1) that the trabeculae always cross each other perpendicularly, and (2) that they fall perpendicularly on the articular surface. This allows the bone to withstand great pressure. In a frontal section 2 groups of trabeculae are seen, 1 for each tuberosity, which start from the lateral faces of the bone and run perpendicular to the corresponding articular surface. The space between the 2 groups appears to be occupied by the section of the trabeculae seen in the sagittal view. These trabeculae are bound by other trabeculae that run in a horizontal direction. In a transverse section, the trabeculae show between their little canals, the dimension of which varies according as they are located in front, back, or on the sides.

This explains the line of fracture which is usually vertical in the direction of the trabeculae. Exceptionally it may be oblique and rarely transverse. The direction of the fracture line varies of course, with the point of termination of the tra-

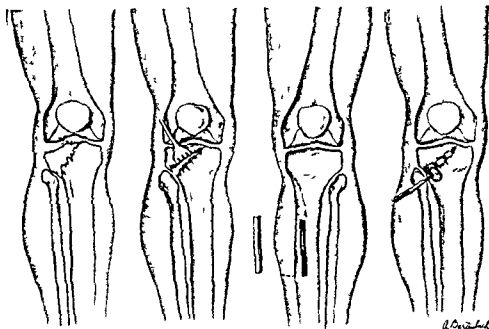


Fig. 2 Schematic drawings showing the major steps in the procedure for elevating the depressed condyle of the tibia. Reading from left to right: 1, A typical depressed tuberosity of the tibia; 2, The depressed condyle elevated into position by means of an osteotome and held there by a retractor; 3, The bone graft removed from the flat surface of the opposite tibial condyle by means of an electric saw; 4, The bone wedges being driven in to maintain the depressed condyle in position.

beculae. The farther down the fracture line is from the articular surface, the more nearly vertical it is, with a tendency to become horizontal as it approaches the articular surface. In cases of direct fracture the lines follow no particular course. In these cases the line of fracture follows the line of force applied, and this would appear to vary with the degree and duration of the force.

In the newer types of bumper fractures, vascular involvement with gangrene may result if the injury to the vessels occurs below the openings of the inferior genicular arteries, or veins, because no collateral circulation is possible (Fig. 1).

Cubbins and associates have classified fractures of the lateral condyle of the tibia into 5 types and have suggested treatment of each type.

Type 1. Fracture of the lateral condyle. The fragment is displaced outward with little if any of the bearing surface depressed.

Type 2. Depressed fracture of the lateral condyle. A large fragment is displaced outward and the medial portion of the bearing surface is depressed obliquely downward and inward.

Type 3. Oblique depression fracture of the bearing surface with only a small portion of the lateral fragment retaining normal level.

Type 4. Depression fracture of the posterior portion of the lateral condyle, with the forward portion intact.

Type 5. Depressed fracture of the anterior portion of the lateral condyle, with the posterior portion intact.

ETIOLOGY AND MECHANISM

One may produce a fracture of the lateral tuberosity of the tibia by falling from a height with the leg extended and an abduction force directed at the leg, or by an automobile fender or bumper striking the extended and locked knee. Something must give way. In unusual cases there may result a tear in the lateral collateral ligaments of the knee or of the lateral condyle of the femur. The internal collateral ligament or the medial tuberosity of the tibia may be avulsed, but most often the lateral articulating surface of the tibia gives way and a knock knee deformity results.

N. Barbilian, quoted by Arthur N. Collins, was unable to produce fractures of the tibial head by mere internal or external rotation. When to torsion was added a direct blow, the fracture resulted.

Eliason is of the opinion that the point of contact of the femoral condyle with the tibial plateau will depend on the degree of flexion of the knee at the time of direct trauma. In flexion the posterior portion of the tibial plateau, or shelf, would tend to be crushed, while in extension, the crush would be more anterior, with a resultant "back-knee."



Fig 3 Case 1 M G aged 26 years Admission No 162586, Patient was struck by an automobile while crossing the street and was admitted to Cook County Hospital January 17 1937 A fracture of the left tibia and fibula at its upper third was sustained There was a posterior displacement of the lower fragments The roentgenogram was taken the next day and shows good alignment of the fragments after manipulation and closed reduction under ether anesthesia

Fig 4 Case 1 M G Picture showing the presence of marked cyanosis of distal end of foot with a large bleb formation which became infected Two days after entrance the patient began a septic course Skeletal traction was applied through a Steinmann nail in the os calcis Amputation below the knee was done on February 12 1937 The wound healed cleanly Union present in fracture Note line of demarcation below upper third of leg

SYMPTOMS

Pain over the site of the injury is a constant finding The knee joint is swollen and the patella may be floating because of the intra articular hemorrhage There is limitation of flexion or extension depending on the type of injury, and there may or may not be a genu valgum depending on the position of the fragments The history, symptoms, and clinical signs are inconclusive The roentgenogram establishes the diagnosis



Fig 5 Case 2 H S aged 9 years Patient was struck by automobile and entered Cook County Hospital October 8 1936 with a fracture of the lower third of the femur Gangrene of distal end of foot due to injury to blood vessels

TREATMENT

At present, bone surgeons are divided into two camps when the question of treatment comes up for discussion Cotton (3), Eliason (quoted previously), and Sever, to mention a few, would prefer not to operate on any type of fracture of the lateral tuberosity of the tibia

The non operative methods consist of manipulating the fractured fragments into position and impaction by the Cotton method, such as striking a sharp blow with a mallet to bring the fragment upward into position, or using a *redresseur* after the method of Forrester, or applying strong finger pressure to the fractured fragments, pushing them into place The knee is kept in an overcorrected position during the manipulation and is fixed in a plaster cast, extending from the toes to the groin The cast is usually kept on for 6 to 8 weeks After that, passive and active motion is begun The patient is fitted with a walking caliper and no weight bearing is allowed for at least 3 more months

To operate in an area of crumbled and crushed cancellous bone would add insult to injury In case of wide separation of a good sized fragment of the tibial tuberosity without much comminu-



Fig 6

Fig 7

Fig 6 Case 3 L C aged 17 years, admission No 1621656, was struck by an automobile and admitted to Cook County Hospital in marked shock on December 26 1936 Roentgenogram taken 8 days later showed marked swelling of the soft tissues and overriding of the bone fragments The patient began a septic course 3 days after admission The foot was cold and cyanotic There was absence of the dorsalis pedis pulse Bleb formation and moist gangrene developed Amputation 2 weeks later did not relieve sepsis Osteomyelitis of the other leg developed

Fig 7 Case 4 C W aged 68 years admission No 1599674, was struck by an automobile and admitted to Cook County Hospital on September 6 1936 The patient was in marked shock There were fractures of both bones of both legs in the upper third No cyanosis or gangrene developed The patient never came out of shock and died September 15, 1936

Fig 8 Case 5 A W, aged 65 years admission No 1575614, was admitted to Cook County Hospital May 8 1936, with a history of having injured her right knee when her heel caught in a knot hole while going down a wooden staircase The right knee was swollen and painful There was excess lateral mobility of the knee joint and the weight bearing line was disturbed Manual manipulation and immobilization in a plaster case for 8 weeks Note the amount of bone destroyed due to compression

Fig 9 Case 5 Roentgenogram taken 4 months after the injury showing regeneration of the depressed lateral tuberosity of the tibia but there is present a "knock knee" deformity The patient is shown wearing a walking caliper A wedge operation to raise the depressed condyle is indicated



Fig 8

Fig 9

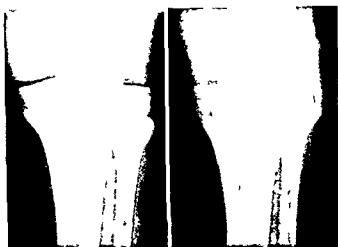


Fig 10

Fig 11

Fig 10 Case 6 Patient aged 40 years, admission No 1598512, was admitted to Cook County Hospital September 1, 1936 with a history of being struck by an automobile while standing on the street Note the large bone fragment of the lateral tuberosity of the left tibia with practically no depression Attempt at manipulation failed to force the loose fragment in place

Fig 11 Case 6 Open reduction showed that the lateral meniscus was interposed between the fragments The torn semilunar cartilage was removed and the fragment fixed in place with a long screw Roentgenogram taken 10 weeks postoperatively shows complete union Note perfect weight bearing line

tion, crushing, or impaction, and manual or closed reduction failing, due perhaps to interposition of soft tissues such as fragments of semilunar cartilage, open reduction and fixation is indicated

When there is marked valgoid deformity due to loss of bearing surface from impaction, Cotton's suggestion to do "Macewen's" supracondylar osteotomy should be considered



Fig 12 left Case 7 J L aged 48 years admission No 162,031 was struck by an automobile and admitted to Cook County Hospital January 23 1937 with a comminuted fracture of the upper third of the tibia and fibula. Roentgenogram taken 6 weeks after the injury shows very little callus formation. No union was present 10 weeks after the original injury.

Fig 13 Case 7 Photograph of leg showing dry gangrene of toes and slough on dorsum of foot

We wish to make a preliminary report of a special technique devised by the senior author, F G Dyas for elevating depressed tuberosities of the tibia. The procedure is essentially as follows:

A longitudinal incision over the affected condyle is made. The condyle is elevated to the level of the tibial articular plateau by an osteotome. By means of a motor driven saw a graft 8 to 10 centimeters long and about $1\frac{1}{2}$ centimeters wide is cut from the flat surface of the opposite tibia. The graft is then driven between the elevated condyle and the shaft of bone for about 2 centimeters and then cut off. The same procedure is repeated until a row of wedge shaped portions of the graft completely fill in the hiatus between the small upper fragment and the shaft of the bone. These small grafts exercise a continuous pressure upward upon the small articular fragment forcing

it against the articular surface of the femur. The wedge grafts are introduced in such a manner that the cut surface of the graft will come in contact with the freshened surface of the fragments to favor osteogenesis. We have not followed our cases for a sufficient length of time to present data of comparative results, but wish to report this procedure with the hope that, perhaps, some other surgeons may attempt the same procedure and thus increase the number of cases in order that the merits of this operation may be evaluated.

SUMMARY AND CONCLUSIONS

- 1 The recent types of bumper fractures occur below the knee joint and therefore the frequency of indirect traumatic gangrene is increasing.
- 2 To operate in an area of crushed and crumbled cancellous bone would add insult to injury.
- 3 A new technique is described for elevating depressed condyles of the tibia.

REFERENCES

- 1 BARBILIAN N. J de chir. 1916 28 663
- 2 COLLINS, ARTHUR N. Tibial fractures into the knee joint. Minnesota Med. 1930 13 285-292
- 3 COTTON F J. Fender fractures. Surg. Gynec. & Obst. 1910 62 442-443
- 4 COTTON F J and BERG RICHARD. Fender fractures. New England J Med. 1929 201 989-995
- 5 CUBBINS WILLIAM R. CONLEY ARTHUR H. CALLAHAN JAMES J and SCUDERI CARLO S. Fractures of the lateral condyle of the tibia, classification, pathology and treatment. Surg. Gynec. & Obst. 1934 59 461-468
- 6 ELIASON ELDREDGE L. and EBERLING WALTER. Non-operative treatment of fractures of the tibia and femur involving the knee joint. Surg. Gynec. & Obst. 1933 47 658-667
- 7 FORRESTER C R G. Imperative Traumatic Surgery. New York: Paul B. Hoeber Inc. 1929
- 8 LEE HAROLD C. Fractures of the tuberosities of the tibia. New England J Med. 1931 204 583-594
- 9 SEVER, JAMES WARREN. Fractures of the tibial spine combined with fractures of the tuberosities of the tibia. Surg. Gynec. & Obst. 1922 35 358-364
- 10 STERN W G and PAPPERT L E. Healing of the newer bumper fractures. J. Am. M. Ass. 1935 105 2147-50

FRAGMENTATION AND EXPULSION OF A COMMON DUCT STONE INTO THE DUODENUM BY USING ETHER AND AMYL NITRITE

WALTMAN WALTERS, M D, D Sc, F A C S, and HARRISON R WESSON, M D,
Rochester, Minnesota

THE more general use of roentgenologic visualization of the common bile duct and hepatic duct by the injection of opaque substances into them both at the time of, and subsequent to, operation has assisted in determining the restoration of function of the extrahepatic biliary tract following surgical procedures (6). In this respect evidence of persisting pancreatitis is noted by persisting narrowing of the pancreatic portion of the common bile duct and dilatation of the duct above the enlarged pancreas. Occasionally, reflux of the opaque substance into the duct of Wirsung is present. On a few occasions in our experience, subsequent studies of the common bile duct by this method have proved that a lesion which appeared to be a pancreatitis disclosed evidence of an intermittent spasm of the sphincter of Oddi, and in an occasional rare case a small carcinoma of the papilla of Vater was found (5). Following difficult operations on the gall bladder and common bile duct in cases in which patients were seriously ill, we have, on two occasions, demonstrated the presence of stones in the ampulla of Vater, which produced clinical symptoms of intermittent obstruction. In one of these cases the stone was removed surgically while in the other case fragmentation of the stone was produced by instillation of ether into the common bile duct, as recommended by Pribram. The ether, in addition to causing fragmentation of the stone, increased the intraductal pressure. By dilating the sphincter of Oddi by inhalations of amyl nitrite, as recommended by McGowan, Butsch and Walters, fragments of stone were forced from the common bile duct into the duodenum. Roentgenographic evidence confirmed the clinical diagnosis of stone in the ampulla of Vater (Fig. 1) and showed the fragmentation of the stone after several instillations of ether into the duct (Fig. 2) and the expulsion of the fragments into the duodenum. Following this expulsion of the stone, roentgenographic examina-

tion which was made after the injection of brominol revealed that the outline of the common bile duct was normal and that the brominol passed freely into the duodenum (Fig. 3). Closure of the T-tube prior to these procedures was followed by attacks of pain and pylorospasm, closure of the T-tube subsequent to fragmentation and passage of the fragments of the stone into the duodenum produced no symptoms of biliary obstruction. The T-tube was removed, the sinus healed promptly, and the patient has been free of any evidence of disease of the biliary tract. He has been in excellent condition since the middle of February, when the T-tube was removed.

REPORT OF CASE

A priest, 50 years of age, was first seen at the clinic November 9, 1936. A cholecystectomy had been performed in 1928. In the year before he came to the clinic he had suffered on 2 occasions from symptoms of obstruction of the common bile duct, that is, pain in the right upper quadrant of the abdomen, nausea and vomiting. During the last attack, which had occurred only 2 weeks before we first saw him, there had been associated chills, fever, and a mild degree of jaundice. Examination revealed that the jaundice had subsided and the patient was in good physical condition. Because of the history of the 2 attacks which were characteristic of obstruction of the common bile duct, a diagnosis of a stone in the common bile duct was made.

Exploratory laparotomy was performed on November 13, 1936. The stump of the gall bladder containing a stone was removed. The hepatic artery was in an anomalous position, it crossed the common bile duct from left to right so that although the common bile duct was enlarged to about 2 centimeters in diameter, only a portion 1 centimeter in length was not covered by the artery. In this exposed portion of the common bile duct a small incision was made, a scoop was introduced into the ampulla, and a dark, irregular stone, which measured about 1.5 centimeters in diameter, was removed. Because of the position of the anomalous hepatic artery and the patient's obesity, it was impossible to explore the intrahepatic ducts as an exploring scoop or forceps could not be inserted upward around the curve of the artery. It was necessary, therefore, to be content with dilatation of the sphincter of Oddi with a large sized scoop, which measured approximately 1.2 centimeters in diameter, hoping that if stones were present in the hepatic duct they would pass through this dilated sphincter.

Postoperative convalescence was uneventful and the patient was dismissed from the hospital 18 days after the operation. In all cases in which a T tube has been inserted

From the Section on Surgery, The Mayo Clinic, and the Division of Surgery, The Mayo Foundation.



Fig. 1

Fig. 1. Choledochogram showing filling defect in the distal end of the common bile duct and a small amount of the medium in the duodenum.



Fig. 2

Fig. 2. Choledochogram made after the injection of ether and showing a fragmentation of the stone which was



Fig. 3

causing the filling defect.

Fig. 3. Choledochogram showing that the common bile duct has emptied without obstruction to the medium and that the stone which was causing the filling defect in the other figures has been expelled into the duodenum.

to drain the common bile duct it is our custom to make a choledochogram (4, 6) before removal of the tube. This is done to insure complete emptying of the common bile duct and hepatic duct in a 10 minute period and also to exclude persisting obstruction as a result of pancreatitis, stones, carcinoma or spasm of the sphincter of Oddi. A choledochogram which was made December 1, 1936, 18 days after the operation, showed a dumb-bell shaped filling defect in the distal end of the common bile duct (Fig. 1). The patient was sent home for 4 weeks and instructed to clamp his T tube continuously during the last week before he returned to the clinic. During this week, while the T tube was clamped continuously, the patient experienced an attack of pain in the right upper quadrant of the abdomen with accompanying nausea and vomiting. Jaundice was not present. A second choledochogram which was made on December 28, 1936, revealed that the filling defect was still present in the distal end of the common bile duct.

Our exploration of the common duct had been thorough at the time of the operation so we felt justified in assuming that the stone which we could now demonstrate in the common duct had been washed down by the flow of bile from the hepatic ducts.

In 1933, Finbram described a method whereby he had been able to dissolve certain types of stones in the common bile duct by the injection of ethyl ether through a T tube leading into the common bile duct. Accordingly, about 5 cubic centimeters of ethyl ether was injected very slowly into the T tube daily on January 3, 4, and 5, 1937. There was some pain associated with the procedure but this could readily be relieved by opening the T tube, thereby releasing the increased intraductal pressure which had been caused by the rapid vaporization of the ether when brought to

body temperature. Care was exercised to leave the T tube open for at least 3 hours following each injection. A choledochogram which was made on January 6, 1937, revealed a picture which we interpreted to mean that there had been a fragmentation of the stone in the distal end of the common bile duct (Fig. 2). The picture, we thought, demonstrated very clearly that small amounts of the radiopaque medium had infiltrated through fragments of the stone. We felt that we had been unable to introduce enough ether into the T tube at one time to insure that a proper amount of the solvent reached the stone. The rapid vaporization of the ether caused a rapid increase in the intraductal pressure which made it necessary to open the T tube. This was followed by a prompt expulsion of gas and liquid. Therefore, on Dr. Osterberg's suggestion, we used for our subsequent injections a mixture of 1 part ethyl alcohol and 2 parts ethyl ether. Injections into the T tube were made again on January 9, 1937, and January 11, 1937. By using this mixture of ether and alcohol, we were able to inject about 5 cubic centimeters at a time before releasing the T tube and were able to use at least 10 cubic centimeters of the mixture each day. On January 11, 1937, about 3 hours after the injection had been made, the T tube was clamped. About 2 hours later the patient began to experience rather severe pain in the right upper quadrant of the abdomen, with associated nausea. He was given the contents of a pearl of amylnitrite by inhalation and the prompt relief of the pain was dramatic. A choledochogram, which was made on January 15, 1937, showed that there was no filling defect in the outline of the common bile duct and that the duct emptied its contents readily into the duodenum (Fig. 3). The T tube was kept in place for another 3 weeks, during which time it was kept closed continuously. The patient

experienced no discomfort or nausea during this time. Consequently, the T tube was removed January 30, 1937, and the sinus tract closed promptly. The patient said, during a recent examination (April 7, and August 7, 1937), that he was in excellent health and had had no recurrence of his biliary symptoms.

SUMMARY

A case is reported in which the presence of a persisting stone in the ampulla of Vater was demonstrable by cholelithography. Fragmentation of the stone with ether and expulsion of the fragments into the duodenum were accomplished by increasing the intraductal pressure by means of ether vapor and dilatation of the sphincter of Oddi by inhalation of amyl nitrite. The value of postoperative studies of the conformation and the emptying time of the common bile duct, by roentgenographic means after the injection of opaque substance into the common bile duct, is emphasized.

REFERENCES

- 1 BUTSCH, W L, MCGOWAN, J M, and WALTERS, WALTERMAN Pressure in the common bile duct, a preliminary report. *Proc. Staff Meet. Mayo Clin*, 1936, 11 145-150
- 2 MCGOWAN, J M, BUTSCH, W L, and WALTERS, WALTERMAN Pressure in the common bile duct of man, its relation to pain following cholecystectomy. *J Am M Ass*, 1936, 106 2227-2230
- 3 PRIBRAM, B O New methods in gall stone surgery. *Surg, Gynec & Obst*, 1935, 60 55-64
- 4 WALTERS, WALTERMAN The pathological physiology of stone in the common bile duct, clinical and surgical significance. *Surg, Gynec & Obst*, 1936, 63 417-424
- 5 Idem Pathologic physiology of the common bile duct and its relation to disease of the biliary tract. *Proc. Inter State Postgrad M Assembly N America*, 1930, 21-25
- 6 WALTERS, WALTERMAN, and THIESSEN, N W Visual methods of studying the physiology of the common bile duct. I The problem of pancreatitis and sphincteritis. *Proc. Staff Meet. Mayo Clin*, 1934, 9 772-775

LOCALIZATION AND REMOVAL OF FOREIGN (METALLIC) BODIES

DAVID A WILLIS, M D F A C S S , Chicago, Illinois

THOUGH the removal of foreign bodies from the tissues, particularly needles imbedded in the hands and feet, is considered to be a difficult procedure, it is the opinion and experience of the author that if properly performed the operation should require little time and cause little difficulty.

Several rules concerning the subject may be stated

1 The time required for, and the ease with which, removal of the foreign body can be accomplished, is proportional to the accuracy with which the object is localized (which includes accurate skin markings) and the care with which the operation is planned

2 No massive dissections should be necessary, the removal of the foreign body (needle) seldom requiring an incision longer than $\frac{3}{8}$ of an inch

3 The anatomical part containing the foreign body should be fixed and held in an optimum operating position from the time the localization

and skin markings are made until the foreign body has been removed

4 Removal of a foreign body should never be attempted without the aid of a fluoroscope

Since the same principles and method may be applied to other parts of the body, the removal of needles from the hand only will be described here

Localization The hand is thoroughly scrubbed with soap suds dried, and fixed with tape ties to a perforated board as shown in Figure 2 Under the fluoroscope, the position of the needle is now marked on the skin in the following manner An ordinary paper clip is straightened out leaving one loop as a handle, and the clip is placed on the skin and superimposed over the image of the needle as seen on the screen The clip held in this position on the skin is used as a ruler, and a line is drawn on the skin with gentian violet The line *1 B* in Figure 2 is thus obtained Under the fluoroscope again the ends of the needle are marked resulting in lines *CD* and *EF*, Figure 2 Now either the hand or the fluoroscope (if a portable machine is being used) is rotated until a lateral view is obtained and the marking *GH* in Figure 2 is made and indicates the depth as well as the direction of the needle, for it is essential to determine which end of the needle is nearer the skin

Removal The apparatus which has been devised and is illustrated in Figure 1 consists of a forceps of desired shape and size, which has been so insulated and so constructed that its contact with a metallic object closes an electrical circuit and lights a battery controlled lamp The lighting device may be plugged onto the forceps desired A contact button is incorporated for making and breaking the circuit since constant electrical current produces a slight but harmless bubbling in the tissues The apparatus is a single unit and therefore serves both to indicate when the metallic object has been reached and to grasp the object Contact with a nerve will produce a reaction and indicate that an important structure lies in the operative field Only full contact with the metallic object will complete the circuit so that the interposition of any tissue grasped between forceps and needle will prevent the lamp from lighting

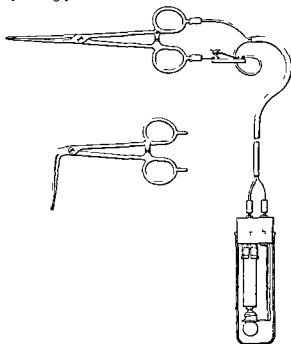


Fig 1 Diagrammatic sketch of apparatus showing forceps lighting device and contact button



Fig. 2 Shows hand and arm fixed to board, and position of needle marked on skin

Extraction of foreign body The hand, fixed to the board, is prepared surgically as the operator desires. Under local anesthesia an incision $\frac{1}{4}$ to $\frac{3}{8}$ of an inch long is made through the skin over the most superficial end of the needle. For a needle in the position as shown in Figure 2, the incision would be made at point B. Under certain circumstances, however, it may be advisable that the incision for approach be made over the middle of the needle. This, however, the operator must plan carefully and accurately. A pressure bandage applied over the incision for a few minutes will generally control the skin bleeding. With the hand again under the fluoroscope, the selected forceps is inserted into the wound and gently directed toward the needle. Contact of forceps tip and needle will be indicated by illumination of the lighting device. The forceps is now opened and with it the needle is gently grasped. A steady illumination indicates that the needle is in the jaws of the forceps, and that no tissue is interposed. The forceps is closed, the hand is removed from the fluoroscope, and the needle is easily extracted. If the needle has been grasped too far from its end for easy extraction through the incision, it may be pushed up against the skin a short distance from the incision and through a minute incision over its palpable end can easily be extruded and extracted. No suturing is necessary. A simple, firm dressing and



Fig. 3 In this photograph the long scar represents an incision made several years ago for removal of a needle, the short one represents incision made recently for removal of needle by forceps method. (The scars have been inked for better visualization)

bandage are applied. The removal of the needle seldom requires more than a few minutes.

In parts of the body where anteroposterior and lateral views may easily be obtained under the fluoroscope, it is well to approach the foreign body as has been described, then to rotate either the fluoroscope or the anatomical part at an angle of 90 degrees and to continue the approach. This procedure enables the operator to observe the distance between the forceps and the object. The foreign body lying in a muscle belly may be seen to move as the forceps lying close to the foreign body is moved. One should not be misled by this fact in believing that contact has been made with the foreign body. Only when the lighting device indicates that contact has been made with the metallic object should the extraction be attempted.

SUMMARY

A simplified method for extracting metallic foreign bodies is described emphasizing a new instrument.

With the aid of this instrument and the method of localization described, extensive and tedious dissections should be infrequent.

A NEW SUTURE FOR TENDON AND FASCIA REPAIR

CHARLES MURRAY GRATZ, M.D., F.A.C.S., New York, New York

IN REPAIRING defects of tendons and fasciæ the tension of the retaining suture tends to cause separation between the fibers and may result in inaccuracy and weakness of the suture line. Research work previously reported¹ has shown that the fibers themselves have relatively high tensile strength, and histological studies have shown that these fibers are covered with a delicate layer of mesothelial cells. Photomicrographs of the Achilles tendon (Fig 1) show that between the individual fibers are spaces which permit synchronization of movements of this tendon.

The method of repairing defects in tendons and fasciæ should be so designed that the strength of the fibers themselves be fully utilized and any slippage should be avoided. The end of the tendon or fascia is re enforced by using a suture which forms an everted V, the apex of the V pointing

From the Department of Surgery, Division of Orthopedics, Columbia University, New York Post Graduate Medical School and Hospital and City Hospital, New York.

¹Gratz, Charles Murray. Biomechanical studies of fibrous tissues applied to fascial surgery. Arch. Surg. 1937, March.

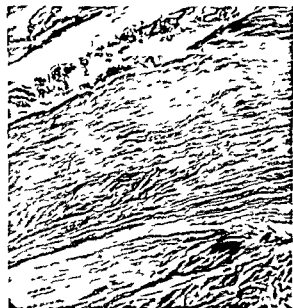


Fig 1 Photomicrograph of the Achilles tendon. The fibers are approximately parallel and spaces will be noted between the groups of fibers as well as the fibers themselves.

toward the defect. The details of placing this re-enforcing suture are shown in Figure 2, A and B. This is obtained by using a figure of eight suture, the portion forming the V being illustrated by heavy lines. After the re-enforcing suture has been placed in position the repair is accomplished by placing the retaining suture through the V of the re-enforcing suture (Fig 2 C). When tension is applied to the re-enforced end of tendon or fascia it is immediately transferred through the re-enforcing suture to the fibers themselves. The same engineering principle is used in handling a cable composed of individual strands of wire. A similar technique has been successfully used by the author in designing instruments for living suture repair.² Figures 3 and 4 show the re-enforcing and retaining sutures in place demonstrated on a human tendon. Silk has been found satisfactory for the re-enforcing sutures, while either foreign material or living sutures may be used for the retaining suture depending on the surgical judgment.

²Gratz, Charles Murray. New instruments for living sutures. Am. J. Surg. 1935, 3, 81-82.

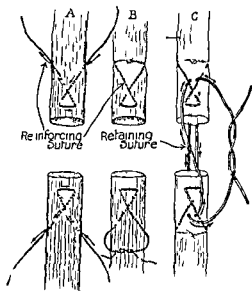


Fig 2 The method of placing the re-enforcing suture is shown in A, the method of tying in B. The heavy dotted lines in B represent the finished V. The method of placing the retaining suture through the V's is shown in C. Whether a single or a double suture is used depends on the individual case.

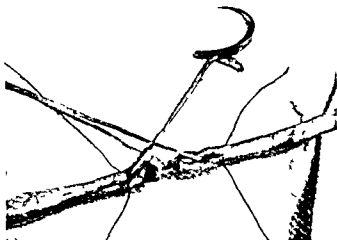


Fig 3 The re-enforcing sutures are shown in place before they are tied In this case a living retaining suture is being used

ment of the operator If a tendon or fascia is being sutured to bone only one re enforcing suture is necessary In the case of repairing



Fig 4 The three sutures finally in place

defects in individual tendons or in fasciæ two re enforcing sutures, as illustrated, are necessary The strength of internal fixation by this method has been found to be adequate, and the method has been used clinically for several years with satisfactory results Increased suture strength and accuracy of internal fixation allows much earlier motion

OPERATIVE CHOLANGIOGRAPHY

P. L. MIRIZZI, M.D., F.A.C.S., Cordoba, Argentina

AT THE third Argentine congress of surgery in Buenos Aires, in 1931, I called attention to the advantages of cholangiography, during operation, in revealing the nature of the obstruction present and the functional capacity of the bile passages. More recently, in a series of articles, I have reported the results of my study of the physiopathology of the hepatic and common ducts of the diagnosis of their pathological states (4-10), and of the surgical procedures indicated in disease of the principal excretory duct (11-13).

Cholangiography as I use it is part of the operation itself. It provides a degree of diagnostic precision such as has never before been attained by other exploratory means. Correct execution of cholangiography and the exact interpretation of the different roentgenographic images obtained become indispensable parts of the abdominal exploratory procedure and necessary requisites in deciding as to whether or not the abdomen should be closed without drainage after a cholecystec-

From the Faculty of Medicine Cordoba, Argentina

tomy. This use of cholangiography is obviously so different from all other uses made of it that I propose to call it "operative cholangiography."

ADVANTAGES OF OPERATIVE CHOLANGIOGRAPHY OVER OTHER PROCEDURES

In order to formulate an opinion as to the condition of the principal bile passages, the surgeon has, apart from operative cholangiography, other factors upon which he can base his decision: (1) the pre-operative data, (2) the findings at operation, and (3) fistulography in the postoperative period. In the first group we have the clinical findings, the roentgenological study—both direct and after the injection of tetraiodine—in addition to the Graham-Cole method. In the second group we have intraperitoneal inspection and palpation, the mobilization of the duodenum and subsequent palpation, choledochotomy and instrumental exploration. In the third group we have a means of study through injection of opaque material through the drainage tube (gall bladder or common bile duct) or through a fistulous tract.

Pre-operative information. As to the clinical findings, every surgeon and physician has had many opportunities to observe the lack of relationship between symptoms and anatomical lesions in the bile passages. Some patients give a history of having had hepatic colic and jaundice, sometimes extending over long periods of time, but in them the principal bile passages seem to be completely free from obstruction, either calculous or mechanical. In other patients gall stones are found associated with spasm at the level of the sphincter of Oddi or with anatomical obstructions in the termination of the common bile duct. In such patients there will be noted a periodical regression of the canalicular defects. Some patients give a history of painful intermittent crises, without fever or jaundice, which suggests chronic cholecystitis, but careful exploration reveals the presence of gall stones and dilatation of the bile passages. Even in the much discussed question of jaundice, whether of hepatic or mechanical origin, in spite of the possibility in the great majority of cases of solving the problem by means of clinical examinations and study of the function of the liver, there are cases in which doubt remains—the patient's condition becomes aggravated and it becomes necessary to clear up the diagnosis.

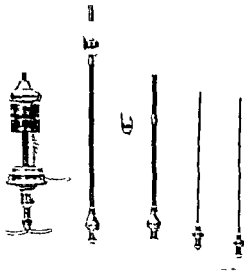


Fig. 1. From left to right: Ten cubic centimeter syringe. Cannula 14 centimeters long the caliber of a No. 13 Charrière with a 15 millimeter diameter olive tip. Cannula 12 centimeters without 10 millimeter olive tip which is at one side, needles for puncture of common bile duct. 1½ millimeter diameter cannula of same caliber as the needle for catheterizing the cystic duct.

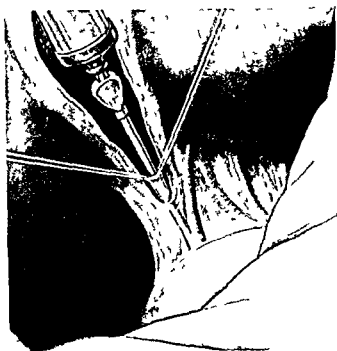


Fig 2 The cannula 12 centimeters long and the caliber of a No 13 Charriere is inserted into the cystic duct which is held on 2 loops of thread. It will be observed that the cannula enters only the proximal one third of the duct.

Direct roentgenography before operation rarely gives data of importance in the study of the principal bile passages except that calculi or concretions located in the gall bladder and common bile duct are occasionally visualized (14). Personally,

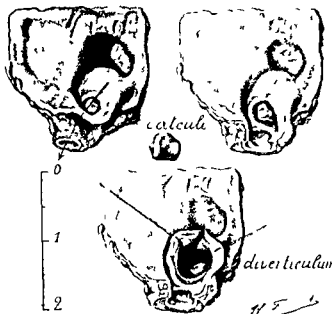


Fig 4 Diverticulum formation in the proximal third of cystic duct the inner wall of which had to be incised, while it was held in the hand, in order to extract a calculus the size of a hazelnut. (Drawing made from the actual organs.)



Fig 3 Taken from an actual case of sclero atrophic gall bladder, in which a stone was found embedded in the proximal third of the cystic duct. Against the resistance of the stone, an opening was made with the point of the knife to allow the passage of a cannula 1.5 millimeters in diameter.

of the hundreds of cases observed, in only 1 have I visualized stones in the common bile duct by means of direct roentgenography, so that I have come to believe that this procedure cannot be

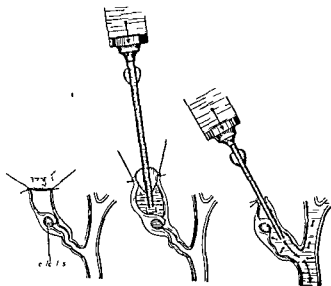


Fig 5 Diagram to illustrate the condition in case shown in Figure 4. The second drawing shows the disadvantage that would be obtained by injecting above the obstacle. In the third drawing the cannula has passed by the obstacle, making it possible to inject the lipiodol.

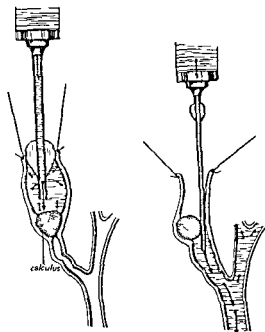


Fig 6 Diagram representing the situation which arises when a calculus is intimately embedded in the wall of the cystic duct the mobilization might rupture the duct or produce fragmentation of the stone.

relied upon Roentgenographical study, in conjunction with the method of Graham Cole, has made possible the visualization of the common bile duct in some pictures obtained in the course of cholecystographic examination of asthenics (3)



Fig 8 The vestibule of the gall bladder is pulled upon with a Grégoire forceps. The needle has punctured the common bile duct and is within the lumen of the duct, indicated by the drop of aspirated bile in the syringe. In inset, method of transfixion to obliterate the opening before withdrawing the syringe after injecting the lipiodol

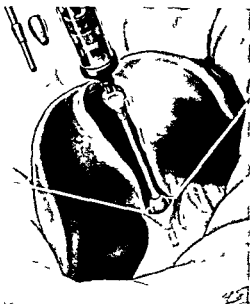


Fig 7 The olive tip is fitted to the cannula when the cystic duct is dilated. In inset the olive tip is shown separate from the cannula.

However, we cannot count upon this source of information as far as the pathological condition of the ducts is concerned

Operative information Palpation of the common bile duct in the course of laparotomy is effective in thin subjects, especially to locate concretions of some size situated in the most accessible part of the duct. In the stout subject, if the pancreas is large, small calculi in the inferior third of the com

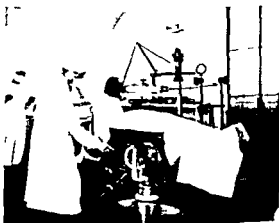


Fig 9 Operating theater showing special arrangements. The patient is on the Potter Bucky diaphragm and is covered with a sterile sheet. The radiologist is ready to put into use the portable x ray apparatus.

mon bile duct or in the papilla of Vater easily pass undiscovered. It is necessary also to be forewarned against the possible existence of neighboring calcified nuclei which may lead one to do a useless choledochotomy. In obese women, the superabundance of fatty tissue makes palpation of the hilum of the liver and neighboring regions difficult. The fatty tissue in these patients lessens the sensation that foreign bodies might give, and the surgeon, through the negative information obtained by digital examination, fails to discover calculi in the principal bile passage. The exploration is more difficult if adhesions exist, if the pancreas is increased in size, and if the liver is hidden beneath the costal arch.

As to duodenal mobilization, it has been suggested that palpation be done after the duodenum has been mobilized, following the Kocher technique. This operative procedure can be done without inconvenience in some cases, it is true, however, that in precisely those patients in whom it would be of the greatest help, difficulties are met. Obesity, adhesions, a deep seated organ, and friability of tissues, make duodenal mobilization difficult. Moreover, it should not be forgotten that in patients in a precarious general condition the dislodgment of viscera increases shock and the possibility of postoperative complications, an operation free from brusque and traumatizing maneuvers should be chosen.

Choledochotomy followed by instrumental exploration is much safer than simple palpation. This has been advocated when the hepatic duct has thickened walls and is dilated. It is not always possible to be sure of these details, but in a normal supraduodenal common bile duct, this finding does not preclude the existence of concretions in the distal third of the duct. It is clear that choledochotomy does not lead to ill effects when the duct is of greater diameter than normal, but incision of a normal duct is more serious in that it may lead to stenosis.

As already stated, choledochotomy, recently freely used, is, without doubt, a richer source of information than simple palpation. Still, one must agree, and in this surgeons of great experience are of the same opinion, that in exploring the hepatic and common bile ducts, it is possible to slip alongside a calculus without the metallic sound detecting it, in the same way it is impossible to recognize intrahepatic concretions. Furthermore, even though some calculi have been removed, it is impossible to be sure that all have been removed, and here again, as foreign bodies are easily displaced and as the exploring sound may slip by the side of the calculus passing into the duodenum,

we may have the erroneous conviction that no obstacle exists. A review of the many articles dealing with the postoperative study of such cases by means of lipiodol injection in order to discover overlooked concretions, will convince one of this.

Also it is true that if there exists a partial or complete obstruction due to pancreatitis, it is impossible to be sure of its nature, for the instrument may pass with difficulty or may be detained.

In dealing with stenosis of the principal bile passages, I will not omit recent discoveries. Vivisection and the study of the results of operations upon the bile passages are concerned especially with the sphincter of Oddi. The role played by this muscular ring in the principal syndrome of the right hypochondrium with or without jaundice, is important. It is of particular interest to the surgeon to know whether stricture of the papilla of Vater has an anatomical underlying cause—that is, an inflammation of the sphincter of Oddi, or if the stricture is simply a result of temporary spasm caused by irritation. When an instrument overcomes with some difficulty the resistance offered by the papilla of Vater, the impression is gained that stricture is present but the impression is not sufficiently accurate to affirm whether the stricture is of an anatomical or functional nature. It is absolutely necessary that the surgeon determine this point for it is on this factor that he will base his treatment. In the case of spasm it will be sufficient to eliminate the local or distal cause of the spasm, while in the case of stenosis or obstructing inflammatory condition in the sphincter of Oddi, deviation of the bile will have to be considered. Furthermore, it is possible for the point of the exploring instrument to enter a cul-de-sac and the impression is given that instead of passing through a permeable papilla, a stenosis is met that does not really exist.

Gentle exploration, of course, if it reveals nothing, has no other untoward effect than that of a useless preliminary choledochotomy, if it is ruthlessly done, however, it may traumatize the pancreas, causing grave complications. All maneuvers in the vicinity of the papilla of Vater predispose to acute hemorrhagic pancreatitis (Schnitzler-Walzel). Doppert observed in Schnitzler's clinic 5 cases of postoperative pancreatitis in 50 operations upon the bile passages, 4 were confirmed at autopsy. The author concludes that any traumatizing manipulation at the level of the transpancreatic portion of the common bile duct and the ampulla of Vater is apt to produce pancreatitis. Here is a further reason, based on the immediate result, for making us hesitant and prudent about the use of instrumental exploration near the head of the

pancreas—the region least accessible to the palpating hand and exhibiting factors likely to produce untoward consequences

Postoperative cholangiography The injection of lipiodol or some like medium through a fistula or drainage tube after operation is indicated when it is desired to determine the permeability of the biliary network. It is done when the condition of things has changed since operation.

Anatomical or functional lesions are susceptible to modification through simple drainage and in surgery of the bile passages in order to eliminate the possibility of recurrence of the obstruction in the distal portion of the common bile duct even when there exist well founded hopes that cholecystectomy will give relief, it is necessary that the exact intensity and nature of the lesions be appreciated during the operation itself. If this knowledge is lacking there is the risk that it may be too late to give relief when the changes have been discovered. Kehr's drainage and common bile duct fistula, more than cholecystectomy, create functional conditions which differ somewhat from those present at the time of operation. This regressive action which is favored by external deviation of the bile is especially true in the presence of spasmodic derangements of the sphincter of Oddi, of incipient strictures of the papilla of Vater and of beginning stenosing pancreatitis. In Professor Haberer's clinic examples have been known in which external choledochoduodenotomy had been performed in spite of the fact that by means of the T tube permeability of the papilla was found. These were cases of stenosis due to inflammation of the sphincter of Oddi in which the stricture of the papilla of Vater and lack of contractility of the hepatic and common bile ducts were the factors producing biliary stasis and made necessary a second plastic operation in order to give relief (18).

No one can ignore the importance of this means of discovering overlooked concretions or for ascertaining whether the anatomical stenosis is of the papilla of Vater or the result of pancreatitis, all lesions for the recognition of which manual or instrumental exploration has been found insufficient or impotent. It is also indisputable that to correct such errors it is necessary to perform a second operation which in the majority of cases is difficult and beset with trouble.

INTRINSIC ADVANTAGES OF OPERATIVE CHOLANGIOGRAPHY

Other authors have recognized the importance of operative cholangiography as a means of studying the principal bile passages and have recommended its application.

Recently I called attention to the usefulness of cysticoduodenostomy (9, 11, 13) in incomplete obstruction, either functional or anatomical, beyond the excretory ducts, by which internal secretion is maintained and the tone of the hepatic and common bile ducts is conserved. These lesions are recognized as such by means of operative cholangiography, thus making possible the institution of a physiological therapeutic measure, based on the conservation of an anatomical structure, the cystic duct, which would be sacrificed in the course of cholecystectomy as usually performed.

In studying the functions and the anatomical conditions of the bile passages, operative cholangiography is of great help. It gives a scientific basis for closure without drainage after cholecystectomy. The bile in the peritoneum observed by surgeons who believe its presence is due to slipping of a ligature, in most cases is testimony that there is an anatomofunctional lesion of the hepatic and common bile ducts that has not been noticed because of the inaccuracy, deceptiveness, and lack of precision in the methods of exploration used. Bile in the peritoneum may also be caused by a supernumerary duct, which generally opens into the hepatic surface of the gall bladder. Indeed, observation of the bed of the gall bladder during the lipiodol injection disclosed that small drops leave the cut duct, which is ligated like any vessel.

Operative cholangiography makes possible the recognition of non-calculous obstacles in the termination of the common bile duct (spasm, inflamed sphincter of Oddi, pancreatitis) it makes more precise the indications for cysticoduodenostomy. Operative cholangiography has placed cysticoduodenostomy among the preferred therapeutic measures in the treatment of gall bladder disease.

Operative cholangiography gives precise information even as to the smallest stones at the papilla of Vater, it is this location which harbors the highest percentage of overlooked calculi.

Intrahepatic calculi also are difficult to find with other methods of examination and it is the opinion of surgeons of authority that operative cholangiography is the method which offers the greatest chances of locating such stones. Santor and Mallet Guy say, "La cholangiographie au cours de l'opération, telle que Munzzi l'a conçue est pratique sur une large échelle, nous paraît aussi trouver dans l'étude de la lithase des voies biliaires intrahépatiques une particulière justification" (15). In my private records I have examples of intrahepatic calculi which were recognized through operative cholangiography. These cases are evidence of the truth of the assertion of the

Lyons surgeons One of the great advantages of operative cholangiography is that with it it is possible to study carefully the condition of the bile passages before and after the extraction of the calculi and to determine the true condition of the common bile duct, thus secondary operations are avoided

Without investigation with lipiodol in the ways advised, it is difficult to recognize pancreatitis and obstructive inflammatory disease of the sphincter of Oddi, in association with stones in the common bile duct. My experience has shown that pancreatitis and inflammation of the sphincter of Oddi in the presence of stones above the stricture are more frequent than is believed. In such cases recurrence of the stones is no strange event, if special attention is not paid to the anatomical lesion at the distal portion of the common bile duct (12)

Operative cholangiography makes orientation possible when the pseudotumoral form of cholelithiasis is encountered. In these cases the hepatic space is blocked by a mass formed by agglutination and the firmly adherent organs. The surgeon is in doubt as to whether he is dealing with a neoplasm or an inflammatory condition, especially if jaundice of the obstructive type is present. If one is fortunate enough to locate the gall bladder by puncture and to extract bile, operative cholangiography, after the injection of the lipiodol into its cavity, will give very useful information which will help in making a decision as to the proper treatment

The precise information furnished with operative cholangiography makes it possible to limit manipulation to a great degree, only strictly necessary procedures being done, thus giving maximum security. We all know how difficult manual exploration is, especially in men—the rigid thorax, the liver in retroposition, a blocked subhepatic space, a sclerotic and atrophied gall bladder, pancreas generally enlarged, and the greater depth of the hypochondrium, all of these factors tend to make manipulation more difficult, furthermore, every day experience confirms the great seriousness and the higher operative mortality in man (17, 19)

From the point of view of technique, investigation of the common bile duct is simplified, because the injection of lipiodol through the cystic duct diffuses and distends the stenosed bile passages in the pancreatico-duodenal portion, which is revealed as being distended, standing out in relief in the hilum of the liver, under these conditions incision presents no difficulty and operative accidents are avoided

UNJUSTIFIABLE OBJECTIONS

In my service operative cholangiography is carried out during operation in all operations upon the gall bladder and the bile passages. The method is entirely innocuous, a fact that is proved by its use in 400 patients operated upon on my service without any inconvenience whatever

It has been objected that lipiodol may be the bearer of micro-organisms. If the present ideas regarding infection of the bile passages are borne in mind, this fear is unfounded. My personal experience has demonstrated that there are no bad effects from this standpoint, I have used operative cholangiography in all cases of suppurating angiocholitis and have had no ill effects from its use

Lipiodol has been thought to produce toxic phenomena. I wish to emphasize that the quantity of lipiodol I inject is minimal, the pressure used is insignificant and one might say that the substance penetrates spontaneously

It has been argued that operative cholangiography prolongs the operation. It must not be forgotten that in many cases the future welfare of the patient depends upon these few minutes of waiting. Remember the great benefits obtained in surgery of the nervous system, in the meticulous technique of gastrectomy as followed by the Austrians and the Germans, and in the careful execution of thyroidectomy for exophthalmic goiter, all these afford sufficient basis for recognizing how valuable is a patiently, carefully performed operation. The bile passages deserve no less careful treatment

The objection has been raised that operative cholangiography requires the use of local and regional anesthesia. To my mind, far from being an inconvenience, this is a great advantage. By avoiding general anesthesia, which is badly tolerated in obese patients, postoperative complications are less frequent. Everyone agrees that, thanks to local and regional anesthesia, operations on the bile passages have lost their gravity, and operative mortality has been greatly lowered

Naturally, when the patient presents some nervous disorder (hysteria, epilepsy, etc.) or when the glands of internal secretion are not functioning normally (tetany, hyperthyroidism), general anesthesia is indispensable. In such patients one must be satisfied with palpation of the passages and choledochotomy, moreover, there remains the recourse to cholangiography, the lipiodol being injected through the drainage tube in the common bile duct

On my service, in the few patients who were frightened at operation or who were very sensitive, it has been possible to inject lipiodol directly

into the cystic duct or into the gall bladder under regional anesthesia so that the surgeon or radiologist could accomplish all that was necessary when the occasion arose

TECHNIQUE

Material required A glass 10 cubic centimeter syringe is used for the injection of the lipiodol. The syringe has a metallic piston which is provided with a screw stem. The beak of the syringe must be adaptable to the cannula or needle as required. Three cannulas are necessary. Two to have the caliber of a No. 13 Charniere, one 12 centimeters and the other 17 centimeters in length, the third cannula is of the same diameter as the needle, 1.5 millimeters. When it is necessary to produce a hermetically tight connection while using a cannula of large caliber in cases of dilated cystic ducts, an olive shaped adapter, 10 to 15 millimeters in diameter can be fitted to the end of the cannula (Fig. 1). A bottle of 40 per cent lipiodol is part of the equipment.

Technique of injection The injection of the contrast substance can be made (a) into the gall bladder, (b) through the cystic duct, (c) after puncturing the common bile duct.

Injection into the gall bladder is indicated when it is inadvisable to mobilize a gall bladder, the cavity of which has not been cut off from the bile passages. Lipiodol, to the amount of 10 to 20 cubic centimeters, is injected into the body of the gall bladder after the bile has been aspirated. The point of puncture must be ligated when the needle is withdrawn. Light pressure is sufficient, in cases free from concretions and with elastic walls for the lipiodol to flow into the bile passages. In other cases in which the walls of the gall bladder are like cardboard and the cystic duct is dilated the flow of the lipiodol is rapid and spontaneous.

This technique has made it possible in some cases to determine the hepatic origin of jaundice when the clinical and laboratory investigation did not solve the question. It was possible also in certain cases of jaundice due to sluggishness in the principal bile passages, to make the diagnosis with certainty. Injection of the gall bladder is indicated in the pseudotumoral form of lithiasis, in which all the organs form one subhepatic block and only the tip of the gall bladder is accessible. Naturally, permeability of the cystic duct is essential. Easy and abundant aspiration of bile indicates that the organ has not been occluded.

Injection through the cystic duct In all those cases in which cholecystectomy must be done, I pay particular attention to the dissection of the

vestibule and the cystic duct, because, by this route, almost all the injections are made. Four different varieties of cystic ducts may be found (a) those of normal and catheterizable caliber, (b) those of normal caliber but in which catheterization is difficult, (c) those obliterated by scar tissue or calculus (d) those which are dilated.

In the normal cystic duct, injection is done with the cannula without the olive tip. A part of the vestibule is always systematically left and this is held by two loops of thread while injection is made.

In the second type, the difficulty is due almost always to the Heister valves which become most fully developed in the vestibular extremity. It is sufficient in these cases to use the fine cannula, which will pass the obstruction and will not rupture the gut. For example, in a thin walled cystic duct, the ordinary cannula with the olive tip was inserted. The lipiodol did not pass the first part of the cystic duct which indicated that the delicate wall would burst if the process of injection were persisted in, the proximal one third was catheterized with the fine cannula, the injection then being made without difficulty. We congratulated ourselves on having made use of this means because it was possible with it not only to make a cholangiographic examination but also because we finally had to perform a cystoduodenostomy as we were dealing with a difficult case of sluggishness (dyskinesia) of the principal bile passages (Huenz Sanatono operated upon August 22, 1933. Case 55, third series).

Obliteration of the cystic duct by scar tissue is exceptional. In my series of cases it occurred in only 2 per cent of the cases. The obstruction is rarely near the opening of the cystic duct, usually it is found near the vestibular extremity of the duct. One should not be surprised when in some cases, the duct is apparently obliterated and yet appears to be permeable when the first drops of lipiodol are injected, because of the action of the lipiodol the walls "unfold." When the obstruction is in the first part of the cystic duct, a small opening below the stricture is made with the point of a knife. The opening is made sufficiently large to allow the passage of a fine cannula (Fig. 3), if the obstruction is proximal to the puncture wound in the duct, there is no alternative but to puncture the common bile duct.

Obliteration of the cystic duct by stone is frequent and generally caused by only one stone. It is not unusual, however, to find stones in line in the duct. In these cases the gall bladder may or may not have been extirpated. When the gall bladder has not been removed, a small opening is

made just below the calculus, large enough to allow the passage of a fine catheter (Fig 3). When the injection is completed care must be taken to avoid regurgitation of the lipiodol by closing the small opening by means of a fine thread suture, with a fine needle. When the gall bladder has been extirpated, the stone can be removed from the duct by gentle maneuver, if resistance is encountered, it is inadvisable to be too strenuous because of the risk of traumatizing the walls of the duct or of breaking the stone, thus facilitating the passage of fragments into the common bile duct. On the other hand, it is difficult to determine whether the immobility of the stone is due to its being closely embedded in the walls, to the valves of Heister, or to the presence of a real diverticulum (Fig 4), the most practical thing to do is to pass a fine cannula to one side of the stone and make the injection (Figs 5 and 6). A ligature is provisionally made after the injection at the level of the vestibule.

In the fourth type, those in which the duct is dilated, the olive tip is fitted to the No. 13 Charrière cannula to avoid regurgitation of the lipiodol (Fig 7). This technique is also followed when the gall bladder is sclerotic and atrophied. In such cases the cystic duct is often so short as to be confused with the vestibule, and the impression is gained of the latter opening directly into the common bile and hepatic ducts.

Puncturing the common bile duct. Thin, elastic walls in the common bile duct are unfavorable for puncturing. Frailty favors tearing and enlargement of the orifice made by the needle, injection of lipiodol carries with it the risk of infiltrating the cellular tissue at the hilum of the liver. Fortunately, puncture is usually made in dilated ducts which have solid and thickened walls, puncture is preferably made without stripping the peritoneal covering from the duct, especially if the walls are thin.

Visibility of the duct is improved if one takes the precaution of gently pulling upon the vestibule with a Gregoire forceps. Puncture is made with the needle mounted on the syringe nine-tenths full of lipiodol, the object of leaving a space empty is to facilitate aspiration of bile, thus making it more certain that correct insertion of the needle has been made (Fig 8). When we are certain that the needle is within the common bile duct, the lipiodol is injected at once. Before the needle is withdrawn, a fine needle with linen thread is used to obliterate the tiny orifice, by transfixion (Fig 8). This detail is important, especially in those cases in which the common bile duct is surrounded by lax cellular tissue, a circumstance

facilitating the diffusion of the lipiodol immediately after it escapes through the perforation.

Precautions and dosage. As a general rule, it must be remembered that the better the tone and activity of the bile passages, the slower and smaller the injection will be. In a common bile duct of normal diameter or slightly dilated and with elastic walls, if more than is necessary is injected, the risk is run of producing spasm in the papilla of Vater or of favoring purely mechanical penetration into the duct of Wirsung. Naturally all these accidents and errors are easily avoided by injecting the lipiodol slowly and in small quantities. In general we inject at the rate of 1 cubic centimeter of lipiodol per minute, when injecting through the cystic duct. In cases in which there are no advanced anatomical changes, 3 or 4 cubic centimeters is injected, this is a sufficient quantity for studying the principal bile passages. The injection is always made slowly—the screw on the stem of the piston helps to do this, the slowness of the injection and the action of Heister's valves, which neutralize all excess pressure, must also be relied upon. With these precautions one can be assured that the lipiodol penetrates spontaneously the principal bile passages, thus making it possible to secure precise data regarding the anatomy and function of the excretory passages.

During the injection into the cystic duct, into the middle third of which the point of the cannula is inserted, the bed of the gall bladder is examined as well as the distal third of the cystic duct and the junction of the ducts. The presence of an abnormal bile duct or of a solution of continuity produced during the operation is recognized by the escape of drops of lipiodol. It is logical that, when the common bile duct is visibly dilated, or when there are evident signs of obstruction, the nature of which is to be determined, 10 to 15 cubic centimeters of lipiodol is injected, the same quantity is used when the injection is made into the gall bladder.

Technique of verification. To verify the condition of the bile passages, we find out if, after removing the stones in the hepatic and common bile ducts, there remain overlooked calculi. For this purpose, after a T tube is inserted in the common bile duct and the choledochotomy opening is narrowed, a quantity of lipiodol, depending on the capacity of the bile passages, is injected through the T tube. It should be remembered that the object is to see the entire extent of the bile passages, extrahepatic and intrahepatic. I have injected as much as 40 cubic centimeters of lipiodol after the stones have been extracted from

the common bile duct, in patients with jaundice and in a delicate condition, without the least ill consequences.

Röntgenography. In my service, a high tension cable is brought from the X ray cabinet to the operating theater. The Coolidge tube is placed on an L-shaped support, movable in all directions, or a portable apparatus may be employed. The patient is placed on the Potter Bucky diaphragm and is covered with a sterile sheet (Fig. 9).

All instruments that might intervene between the tube and the film are removed. Generally 2 roentgenograms are sufficient with an interval of 10 to 15 minutes between exposures, sometimes only one is enough. To obtain a clear image, *absolute immobility of the right hypochondrium* is essential—this can be secured because of the fact that the patients are operated upon under local anesthesia. In this way, without loss of time, the radiologist takes the roentgenograms he finds necessary, they are developed in the laboratory close by, the films are examined immediately on a roentgenogram illuminator in the operating theater, and the operation is proceeded with in accordance with the findings in the roentgenograms.

BIBLIOGRAPHY

1. FRANÇOIS J. La colangiografia durante e dopo le operazioni sulle vie biliari. Quoted in Policlin. Sez. prat. 1936 No 1 35 J. belge de gastro-entérologie 1935 No 6 365
2. HICKEN F. BEST R. and HUNT H. Cholangiography. Visualization of the gall bladder and bile ducts during and after operations. Ann Surg. 1936 103 210
3. KOEMMERELL B. Neue Gesichtspunkte bei Roentgenstudien der extrahepatischen Gallenwege. Fortschr. a. d. Geb. d. Roentgenstrahlen 1936 53 715
4. MIRIZZI P. L. La colangiografia durante las operaciones de las vías biliares. Bol. y trab. Soc. de cirug. de Buenos Aires 1932, 16 No 24, 1133 No 27 1266 No 30 1413 No 31 1466
5. Idem. La Cholecystectomie idéale et la cholangiographie au cours des opérations sur les voies biliaires. Bull. et mém. Soc. nat. de chir., 1933 No 16 723.
6. Idem. La cholecystectomie sans drainage (cholecystectomie idéale). Paris. Masson et Cie. 1933
7. Idem. Technischer Fehler erkannt durch die Cholangiographie während der Operation. Stenose des Hepato-Choledochus durch Ligatur des Zystikus. Zentralbl. f. Chir. 1934, No 49 2837
8. Idem. Dyskinesie und Gallenblasenregeneration. Cystico-Duodenostomie. Deutsche Ztschr. f. Chir. 1935 245 156
9. Idem. Diagnostic des obstructions non calculeuses du cholédoque. Leur traitement par la cystico-duodénostomie. Presse méd. 1936 No 8 150
10. Idem. Spätruptur des Ductus choledochus. (Ein Beitrag zu seiner Pathogenese.) Zentralbl. f. Chir. 1936 No 15 858
11. Idem. Valor e indicaciones de la cístico-duodenostomía. 7th Congreso Argentino de Cirugía. Buenos Aires, 1935 p. 1328.
12. Idem. Litiasis supra-estructural hepato-coledociana. 7th Congreso Argentino de Cirugía, Buenos Aires 1935 p. 1341
13. Idem. Die Anwendung der Cystico-Duodenostomie. Deutsche Ztschr. f. Chir. 1936 246 609.
14. ROBINS S. A. and HERMANSON L. Cholangiography. A modified technique for the X ray visualization of the bile ducts during operation. Surg., Gynec. & Obst. 1936, 62 684.
15. SANTI P. and MALLET-GUY. La lithase des voies biliaires intra hépatiques. Lyon chir. 1936 33 25.
16. SEIFERT E. Zur Operationsprognose der Gallenleiden. Unterschied zwischen männlichen und weiblichen Kranken. Zentralbl. f. Chir. 1936 No 37 1592.
17. STURM F. Erfahrungen mit der Cholangiographie. Zentralbl. f. Chir. 1932 No 14 891
18. TIXIER L. CRAVEL, CH. and CHABANNE, H. Gravité des interventions sur les voies biliaires dans le sexe masculin. Arch. franco-belges de chir. 1932 No 9 3
19. LAYLE and ALME. La cholédochographie. Presse méd., 1929 Feb 6 179

EDITORIALS

SURGERY Gynecology and Obstetrics

FRANALIN H. MARTIN, M.D.
Founder and Managing Editor
1905-1935

ALLEN B. KANAVAL, EDITOR

Associates

LOYAL DAVIS

SUMNER L. KOCH

MICHAEL L. MASON

DONALD C. BALFOUR, *Associate, Editorial Staff*

NOVEMBER, 1937

FRACTURES OF THE NECK OF THE FEMUR

THE treatment of fractures of the neck of the femur has entered a new era. Two factors are responsible for this: (1) the use of the lateral x-ray and, (2) the use of internal fixation. Lateral x-ray views have taught us that certain of the so-called impacted fractures are not impacted at all but are in distinct malposition and are even overlapped. Thirty years ago Whitman showed that bony union could be obtained in the majority of cases, but the long fixation in a cast, an essential part of the treatment, meant a tedious and confining convalescence that led to stiff knees and hips discouragingly slow to respond to treatment. Internal fixation shortens the period of immobilization and stiff joints cease to be a problem.

Smith-Petersen's paper, wherein he advocated nailing the fragments with a triple flange nail, was not published until he had a sufficient number of proved good results to

show that internal fixation was feasible, practical, and safe. He originally advised opening the hip joint, a formidable operation but one necessary in inserting a nail unless some means is used to determine definitely the proper line for such insertion. Various instruments and gadgets have been devised to determine the line of insertion, but a practical and accurate method is the threading and insertion of a cannulate nail or lag screw on a guide wire, the position of which has been previously determined by antero-posterior and lateral x-ray films. This renders exposure of the joint unnecessary.

However, even if the mechanical requirements of reduction and fixation are fully complied with, there is still a "nigger in the wood pile," so to speak. This has to do with the blood supply of the head of the femur. It has been shown that the blood supply of the head of the femur is in a large measure carried to it by the artery which comes from the internal obturator vessel and finds its way beneath the cotyloid ligament to the ligamentum teres and along it to the bone. But, unfortunately, in approximately 20 to 25 per cent of adults this blood vessel is either lacking or is so minute that it fails to deliver enough blood to be of any use. This explains the atrophic changes, with flattening and distortion of the head, in a certain percentage of cases following perfect reduction, fixation, and even the attainment of bony union. Such changes develop 6 months or a year after union, and nothing can be done about it because there is no way of knowing beforehand whether or not this blood supply through the ligamentum teres is present or not. While it is true that femoral heads without this blood

supply will unite to the neck of the femur in a fair percentage of cases when the fracture is correctly reduced and held in place, nevertheless such a faulty blood supply must account for a considerable percentage of non unions. The prognosis as to function in all fractures of the neck of the femur must therefore be guarded no matter how successful the reduction and fixation. It takes at least a year to determine whether or not atrophy of the head will develop.

MELVIN S. HENDERSON

VISION IN SURGERY

TECHNICAL skill in diagnosis and treatment is usually admitted as a virtue of specialism. Much of the emphasis in training for specialists in surgery is laid upon the development of unusual dexterity in manipulative and mechanical methods for arriving at the patient's exact condition and for his relief. However, there always arises incidentally, or should arise, a special kind of perception by means of which the really skillful surgeon can accomplish more by understanding the possibilities of improving his patient as well as by carrying out the details of his diagnosis and surgical care. In a patient with infantile paralysis, for example, the prevention of deformity as well as opportunities for the later use of weakened limbs should be appreciated. Braces and surgical operations for the stabilization of flail joints must be understood to make surgical plans for the patient's future. This applies not only to the specialist but to any physician or surgeon examining such a child, so that even if such treatment is not suggested it will at least not be neglected or criticized through lack of understanding. The failure to understand these possibilities often results in a refusal of

such treatment and patients drift about from one practitioner to another or fall into the hands of irregulars and quacks because correct treatment has not been suggested or explained.

By combining an unusual initial insight into the patient's possibilities with the other attributes of specialists it is possible to arrive at a certain kind of successful result not obtainable otherwise for many surgical conditions.

This phase of the functions of a specialist is not generally appreciated. It is not always employed by the specialist himself. The true surgeon should perceive in the patient as he presents himself certain possibilities that are not discerned by the average practitioner or by the inadequately prepared surgeon who assumes a specialty for which he is immature. One may illustrate by taking the matter of an x ray plate—the x ray diagnostician reads a plate not strictly according to the contents of the film itself but according to the training and experience which he puts into the reading. One sees on an x ray plate not actually what is there, but what he has been trained to see or what his experience in x ray reading enables him to distinguish with the plate before him. Accordingly, the patient obtains from his x ray diagnostician a reading which does or which does not lead to correct diagnosis and treatment as far as the x ray diagnosis is concerned.

It is exactly so in observing patients. The inadequately trained surgeon sees in the patient as he presents himself not necessarily the possibilities that actually exist, but only those possibilities which his training and experience enable him to perceive.

Criticism of specialists by general practitioners often arises in this way. The general practitioner has been able to see neither the patient's condition in its true light nor the

possibilities for remedy or relief. In arthritis, for example, practitioners generally and even medical and surgical specialists without experience in the mechanical prevention of deformity or its surgical correction, sometimes fail to recognize possibilities for the prevention and cure of deformity that would save much permanent disability. The same comment applies with even greater force to the secondary treatment of fractures in patients with poor results following primary treatment. Failure to comprehend the patient's actual condition and his possibilities lie along with an unfamiliarity with the technical methods

by which the treatment is to be carried out and ultimate results are to be obtained.

Those surgeons of experience and training who look upon their specialty as one in which fairly accurate mathematical degrees of diagnosis may be made and results obtained, are those who have the vision as well as the technical skill to apply to each problem all the methods essential for success. This constitutes the sort of surgical equipment that should characterize everyone who hopes to make a success of the practice of any specialty and of surgery in particular.

H WINNETT ORR

LANDMARKS IN SURGERY

THE MUSCLE-SPLITTING OR GRID-IRON INCISION FOR APPENDECTOMY

An Historical Note

SELIM W McARTHUR, M D , Chicago, Illinois

IN VIEW of the world wide adoption of the muscle splitting abdominal incision as an approach for appendectomy, and in view of the numerous references in the current literature as regards the importance of this incision, in the lessened mortality rate, diminished period of hospitalization and freedom from postoperative hernias, a brief note of certain facts concerning the historical origin of this incision may be of interest

In the spring of 1894, Dr Lewis Linn McArthur of Chicago, made application to the secretary of the Chicago Medical Society for a place on the program at a regular meeting to present an original contribution by him concerning a new method of incising the abdominal wall, especially applicable to appendectomies. Originally, he was assigned a place on the June, 1894, program, but due to the length of the program, and the fact that his paper was the last on the list, Dr McArthur agreed on request to postpone his presentation until an early fall meeting of the society

In the *Annals of Surgery*¹, July, 1894, appeared an article entitled "The Incision made in the Abdominal Wall in Cases of Appendicitis, with a Description of a New Method of Operating" by Dr Charles McBurney, surgeon to the Roosevelt Hospital of New York. In this article, Dr McBurney describes the typical muscle splitting incision as now so widely used. He reports having used this method in 4 cases "of recurrent appendicitis," the first having been done on a patient on December 18, 1893, or about 6 months prior to this presentation of the method. He qualifies his recommendation for the use of this method of incision by the statement, "This operation does not appear suitable for cases accompanied by suppuration about the appendix, which require extensive packing with gauze." And in conclusion remarks, "Sufficient time has not elapsed to justify me in presenting the final results as positively an improvement upon those obtained by older methods."

On reading this paper in the *Annals*, Dr McArthur immediately wrote Dr McBurney on August 24, 1894, congratulating him upon his essay and enclosed a copy of his own paper on the same subject, which at the time had not been as yet presented

In reply, Dr McBurney wrote Dr McArthur a cordial letter dated October 10, 1894, apologizing for delay in answering because of absence from home and in this letter graciously acknowledges the fact of Dr McArthur's priority of use of this method of abdominal incision. In addition, some years later, at a dinner in Chicago, given to Dr McBurney, he again publicly acknowledged the same to his Chicago colleagues. This, of course, does not appear in print. The aforesaid letter from Dr McBurney was discovered in November, 1934, among the correspondence in the desk of Dr McArthur at the time of his death. This letter is now deposited at the John Crerar Medical Library in Chicago for simple historic interest, and for similar reason, there follows here a true copy of the letter

Highgate Springs Vt
October 10 1894

My dear Doctor McArthur

Your very kind and interesting letter of August 24th has followed me about in my summer wanderings. It deserved an answer long ago but you will understand now why you have not received one—I am very grateful for your generous congratulations on the operation for the earliest performance of which you however deserve the credit—I supposed that I had devised something entirely new and your letter to me is the first intimation I have had that the operation had even been done by anyone but me. But in these days when active clever workers are so numerous the opportunities to devise anything entirely original are few and far between. I think the operation has hardly been appreciated even by those who have read the description—at least I have seen no comments upon it in the journals of my neighborhood. I think it is destined to supplant all other operations for the removal of the normal or of the chronically inflamed appendix. But who knows. You ask me what my practice is in cases in which an evident abscess exists. Unless some contraindication exists I operate on them at once. If possible I enter the abscess as near the outer edge of the abdomen as may be without opening up the general peritoneal cavity. The incision in the wall of the abscess is made as large as is consistent without opening the general cavity. The cavity is then merely mopped out very gently without irrigation and the appendix sought for. If readily found it is removed. If a difficult dissection or a prolonged search would be required to remove the appendix it is left to itself. The cavity is then moderately packed with iodoform gauze—I almost never use a drainage tube. If it is necessary to open the general cavity in order to reach a deep abscess the same method is applied only taking great care not to infect the uninvolved peritoneum. I should like to know more of your "extra peritoneal" method. Of course no abscess arising in the appendix can be opened without cutting peritoneum—a peritoneum forms the wall of the abscess. If you come to New York I trust you will let me see

With kind regards

Very truly yours
Charles McBurney

(Signed)

Dr McArthur read his own paper before the regular meeting of the Chicago Medical Society on October 1, 1894, at which Dr Nicholas Senn, president, presided. The title of the paper reads "Choice of Incisions of Abdominal Wall, especially for Appendicitis," and it subsequently appeared in print in the *Chicago Medical Recorder* for November, 1894.

In prefacing his essay, Dr McArthur mentions the fact that Dr McBurney had already reported the same method, and that he, Dr McArthur felt, this in itself was adequate recommendation for the method.

In this paper, Dr McArthur draws attention to his having used the method in 59 cases, the oldest of these 3 years prior to this presentation. In contradistinction to Dr McBurney's recommendation he advocates the use of this type of incision in all types of appendiceal inflammation, suppuration, and abscess formation. And in passing, draws attention to the fact that similar principles of muscle fiber separation can and should be used in other areas of the body. In concluding his paper Dr McArthur sums up the recommendations for this method as

having (1) less hemorrhage, (2) clear anatomy (3) least possible danger of hernia, (4) if necessary to enlarge the wound, only one layer of muscle need be sacrificed (5) less suturing, (6) patient need not be as carefully confined to one position, (7) less cellulitis.

The minutes of this meeting of the Chicago Medical Society signed by Junius Hoag, secretary (now deposited at the Chicago Historical Society) show the paper was discussed by Drs John B. Murphy, Alex H. Ferguson, Arthur Dean Bevan, and Samuel Plummer.

An important item, apropos of the historical interest is the statement at the time of Dr E. Wyllis Andrews, that he has used McArthur's method for several years with great satisfaction, and he was greatly impressed with the self closure of the muscle layers, so that frequently he had not inserted a single suture in them on closing the abdomen.

In conclusion, Dr McArthur during the last years of his life, frequently expressed the opinion that this method of muscle fiber separation had been a real contribution to surgical technique from the standpoint of mortality and morbidity.

CORRESPONDENCE

CONGRESS OF UROLOGY, BUENOS AIRES, ARGENTINA

FROM November 28 to December 4, 1937, the Second American Congress and the First Argentine Congress of Urology will be held in Buenos Aires. The subjects for discussion are genito urinary hydatidosis, genital tuberculosis, urography of excretion, and endoscopic surgery of adenoma of the prostate. The president of the Congress is Professor Dr. Bernadino Maraini, Santa Fe 910, Buenos Aires.

SOME OBSERVATIONS ON ORTHOPEDIC SURGERY IN EUROPE

IN THE editorial appearing on page 1094 of the June, 1937, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, Dr. Ralph Ghormley attributed an operative procedure for the treatment of fractures of the neck of the femur to Dr. Faldini of Parma.

The credit for this procedure should have been given to Dr. Ettorre of Milan. Dr. Ettorre first proposed subtrochanteric osteotomy for the treatment of fractures of the neck of the femur in old people in 1933 at the congress of the German Orthopedic Society. At the last congress of the International Orthopedic Society, to which Dr. Ghormley referred, it was Dr. Ettorre, and not Dr. Faldini, who made the presentation of the patients operated upon by this method.

CARCINOMA OF THE COLON—A CORRECTION

IN THE article entitled "Carcinoma of the Colon" by Moses Behrend, the last sentence in the paragraph on anesthesia appearing on page 513 of the October, 1937, issue of SURGERY, GYNECOLOGY AND OBSTETRICS should read "In somewhat over 3000 cases I have never had a death following the use of neocaine."

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE authors state that they have published their book *Carcinoma of the Female Genital Organs*,¹ of some 215 odd pages because of the lack of any 'work fully illuminating the question of carcinoma of the female sexual sphere'. Malinowsky and Quater have obtained the contributions of some 9 other specialists in various branches of medicine to make it a more comprehensive work. The opening chapter is a general discussion of the pathogenesis and etiology of tumors under three main heads: namely, inciting, predisposing and accessory factors. The authors discuss clinical and experimental data concerning the controversial question of "precancerous condition of tissue." They also point out the significance of the chronic irritation theory by Virchow in the development of tumors and confirm the fact that they may develop from implantation of embryonic tissue as stated by Cohnheim. The various and sundry irritants are discussed with their relationship to tumor development and the statement is made "the duality of the nature and etiology of tumors is beyond any doubt." They feel that heredity does have some influence on the appearance of tumors.

The next two chapters deal with the pathology and clinical picture of carcinoma of the uterus and mammary gland. The authors stress the importance of the classification of uterine carcinoma into cervical or that of the vaginal portion, endocervical or that of the canal, and that of the body or fundus of the uterus because of the differences in rate and type of growth and metastases although they state that for clinical purposes they divide only into two groups: carcinoma of the cervix and carcinoma of the body of the uterus. They discuss the pathology in relation to the development of various signs and symptoms in the patient.

In chapter four the authors present more rarely observed forms of carcinoma of the female genital organs such as that of the ovaries, fallopian tubes, vulva and vagina including the Krukenberg's tumor. In the following chapter the question of metastases of carcinoma of the ovary is covered in detail.

Chapter six covers the surgical treatment of carcinoma of the uterus giving several illustrations of technique and discusses different methods of treatment including the Wertheim abdominal approach. In the next chapter the authors discuss the treatment of carcinoma of the uterus with radiant energy, namely radium and roentgen ray, and bring out the

various factors involved in the comparison of this method with surgical procedures. Chapters eight and nine bring out the various proposed methods of treatment of inoperable carcinoma, including the use of calcium salts.

Chapter ten is a discussion of carcinoma of the mammary gland including diagnosis, treatment, and prognosis. The authors stress the importance of differentiating between benign and malignant lesions.

In the final chapter the authors discuss carcinoma of the female sexual sphere in its relationship to economics and disability, and more specifically in its relationship to the insurance problem.

BY FORD F. HESKETT

IN this relatively small text,² Dr. Carter, one of the younger cardiologists of Chicago, has attempted the difficult task of presenting the extensive subject matter of electrocardiography. A portion of the original material for this book, which has been amplified by the author, was published in the *Journal of American Medical Association* a few years ago. On the whole the book is somewhat too complicated for the beginning student of electrocardiography, and not sufficiently extensive for the trained cardiologist. The large number of electrocardiograms is representative although many of the cuts are too small. The bibliography is rather well selected. One might question some of the author's terminology particularly the matter of right and left bundle branch block which is not in accord with the conclusions reached by the authoritative American Heart Association. Another point of disagreement is the matter of ventricular preponderance. The book has a number of satisfactory points.

C. C. MAHER.

THE first volume of Weibel's *Frauenheilkunde*³ is a complete textbook on obstetrics of 627 pages. The volume is very profusely illustrated with black and white as well as some unusually fine colored illustrations, and many clear roentgenograms some of which have been advantageously retouched. The subject matter is sound and is presented in a direct, concise manner reflecting the extensive knowledge and long teaching experience of the author. The book is printed on good stock well suited to the illustrations, in clear type interspersed with bold type for key words and headings. An adequate and complete index is appended. The reviewer anticipates

¹THE FUNDAMENTALS OF ELECTROCARDIOGRAPHY: INTERPRETATION By J. Bailey Carter, M.D. With a foreword by Horatio Burt Williams, M.D. Springfield Ill. and Baltimore Md. Charles C. Thomas 1937.
²LEHRBUCH DER FRAUENHEILKUNDE. By Prof. Dr. W. Weibel. Vol. I. GEBURTSHILFE. Be. Lin and Vienna. Urban & Schwarzenberg 1937.

³CARCINOMA OF THE FEMALE GENITAL ORGANS. By M. C. Malinowsky and E. Quater. Translated from the Russian by A. S. Schwartzmann, A.B. M.D. Boston. Bruce Humphries Inc. 1935.

with pleasant expectancy the appearance of Weibel's companion volume, devoted to gynecology. The work is recommended to all students and practitioners of obstetrics.

IRVING F. STEIN

IN Arthur E. Guedel's *Inhalation Anesthesia*¹ we have at last a very practical guide for the student in anesthesia and for the experienced anesthetist. Dr. Guedel's principles of inhalation anesthesia have been used by many of us for years, the signs of anesthesia, as outlined by him, have been of maximum importance in guiding us through trying anesthetics.

This manual is practical, basic in its principles, concise, and brief in its delivery. It is hoped that Dr. Guedel will continue in his writings to give us the much needed complete text and reference book in anesthesia.

MARY KARP

IT is impossible in the present stage of our knowledge of endocrine physiology to do more than sketch the outlines of the subject, but a helpful, well documented presentation in one volume of clinical endocrinology is made by Werner in his recent book.² Necessarily the extent of the field covered makes the discussion of many subjects quite superficial. Any one of the many syndromes is worth a book in itself. Terms remain in use that the immediate future will disclose as inaccurate or misleading. Treatment is unsatisfactory and there is still the tendency to confuse the course of natural development with therapeutic results. A great amount of the material in such a book at this time must be regarded as controversial. The discrepancy between physiology and clinical medicine is painfully apparent in such an understanding. After a good discussion of the physiology of the pituitary, for example, the author describes so called bilobar pituitary disorders. The diagnosis at present is based on clinical interpretations rather than physiological tests. The confusion is twofold in that the clinical characteristics are of unknown origin, but they serve as the basis for a diagnosis which, in itself, seems to be a pure hypothesis. Nevertheless, in spite of these difficulties which are at present inescapable, the volume is valuable, worth studying, and suggestive.

PAUL STARR

A MAGNIFICENT monograph³ on ovarian function is that of Kehrer. The contents may be outlined as follows: (1) biologic endocrinologic fundamentals, (2) physiologic amenorrhea, (3) pathologic amenorrhea, (4) the problem of ovarian function in monoglandular endocrine pathology, that is, (a) ovary, (b) deincephalo adenohypophysis, (c) pineal gland, (d) thyroid, (e) parathyroid, (f) thymus, (g) liver, (h) spleen, (i) pancreas, (j) adrenal, (5) the

¹INHALATION ANESTHESIA: A FUNDAMENTAL GUIDE. By Arthur E. Guedel. M.D. New York: The Macmillan Co. 1937.

²ENDOCRINOLOGY, CLINICAL APPLICATION AND TREATMENT. By August A. Werner. M.D. F.A.C.P. Philadelphia: Lea & Febiger. 1937.

³ENDOKRINOLOGIE FÜR DEN FRAUENARZT IN IHRER BEZIEHUNG ZUR OVARIALFUNKTION UND INSBESONDERE ZUR AMENORRHOE. By Prof. Erwin Kehrer. Stuttgart: Ferdinand Enke Verlag. 1937.

problem of ovarian function in biglandular and pluriglandular diseases, (6) the problem of ovarian function in infantilism, (7) the problem of ovarian function in status lymphaticus, (8) the problem of ovarian function in spasmophilia, (9) the problem of ovarian function in obesity, (10) the problem of ovarian function in malnutrition, (11) the problem of ovarian function in systemic diseases, (12) the problem of ovarian function in skin diseases, (13) psychogenic amenorrhea, (14) ovarian function in psychoses, (15) ovarian function in central nervous system diseases, (16) results of failing ovarian function, especially climacteric and castration, (17) diagnosis of cause of amenorrhea, (18) prognosis in amenorrhea, (19) therapy of various forms of amenorrhea—(a) roentgen therapy, (b) surgical therapy, (c) hormonal therapy.

Each of these sections has several subheadings, each is considered in detail, constant reference to the literature is made. There are 50 closely packed pages of bibliography. An index is provided.

Needless to say, this volume will serve as a valuable reference work and an immediate aid to the gynecologist and endocrinologist.

PAUL STARR

POSTOPERATIVE and especially pre operative care are too frequently neglected despite repeated reference to the subjects in current journal articles. A new work⁴ by Dr. Robert L. Mason and collaborators provides excellent reference material on this subject. The reason for this seeming neglect may lie in the fact that the medical student is taught the fundamentals of the diagnosis of a specific lesion and how to treat it but unfortunately he is not taught, or at least it is not impressed upon him, that he is dealing with a living organism that responds as a whole and that sundry essential organs may be affected both by the lesion and its associated physiologic dysfunction, and the stress of the surgical procedure. It is of vital importance that such states as dehydration, anemia, disturbances in the acid base balance, starvation, and the like be corrected if possible before any major surgical procedure is attempted. Coller and his co workers have contributed an invaluable service in their detailed studies on water balance and if their advice is followed many crises may be averted and much postoperative distress can be prevented.

In the preface to his work, "Fundamentals of the Art of Surgery," Watson stated "Today many operations seem so simple that the technical skill should be within the grasp of any man who can use his hands with any degree of dexterity at all, and all that is necessary is to learn the steps of the operation and forthwith go and do likewise. This is a false assumption, which has been proved to be so over and over again. The success of an operation depends on much more than this, it entails first a careful and thorough examination of the patient,

⁴PRE-OPERATIVE AND POSTOPERATIVE TREATMENT. By Robert L. Mason. A.B. F.A.C.S. Philadelphia and London: W. B. Saunders Co. 1937.

second, an adequate pre operative preparation, third a careful anesthesia fourth, the proper organization and equipment of the place for the operation, fifth a due appreciation of the powers of the patient and his ability to stand the strain to be imposed upon him sixth adequate facilities for postoperative treatment and last directions for the after care of the patient The more one sees of practical surgery the more one is impressed by the relative frequency of unforeseen complications, and when one carefully thinks out the cause of these troubles it is only to find that most of them could be prevented" This was written over 10 years ago yet bears repeating again and forms much of the basis of Mason's work.

The pre-operative study of the patient from the standpoint of the operative risk including heart disease hypertension nephritis, diabetes, and the like is discussed Postoperative shock acidosis and alkalosis ileus acute dilatation of the stomach dehydration pulmonary and urinary complications, parotitis thrombosis peritonitis and the like are taken up It is interesting to note the high percentage of serious lung complications reported from their institution At the close of Part I there is incorporated

a very instructive article on superficial burns The wisdom of devoting 30 pages to this subject, which is a well recognized surgical entity, in a work on pre-operative and postoperative treatment may be questioned, this especially in view of the fact that only 4 pages are devoted to shock and its management

In Part II the author discusses the pre-operative and postoperative care of the patient from the view point of regional surgical conditions and operations This part, like the first, is quite comprehensive and very little which is of significance is omitted The style of the presentation is good and the text is well illustrated and easily read One may question the advice as to re-operation in the presence of post-operative hemorrhage after gastric surgery A blood transfusion obviates this necessity in the majority of cases and eliminates the danger incident to an operation

The final impression left by this work is that it will find a great field of usefulness in the hands of the interne resident, and young and inexperienced surgeon Its conciseness and brevity are added attractions

JOHN A. WOLFER

BOOKS RECEIVED

Books received and acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender Selections will be made for review in the interests of our readers and as space permits

OPERATIVE OBSTETRICS A GUIDE TO THE DIFFICULTIES AND COMPLICATIONS OF OBSTETRIC PRACTICE By J M Munro Kerr LL.D. MD, FCOG 4th ed With the Assistance of Donald McIntyre MD FCOG and D Fyle Anderson MD Baltimore William Wood & Co 1937

THE POSTMORTEM EXAMINATION By Sidney Farber MD Springfield Ill and Baltimore Md Charles C Thomas 1937

THE 1937 YEAR BOOK OF RADIOLOGY DIAGNOSIS Edited by Charles A Waters MD Associate Editor Whitmer B Furor MD THERAPEUTICS Edited by Ira I Kaplan BSc MD Chicago The Year Book Publishers Inc 1937

POST GRADUATE SURGERY Edited by Rodney Maingot FRCS (Eng) Vol 3 New York D Appleton Century Co Inc 1937

THE ROENTGENOLOGIST IN COURT By Samuel Wright

Donaldson AB MD FACR Springfield, Ill, and Baltimore Md Charles C Thomas, 1937

THE THINKING BODY A STUDY OF THE BALANCING FORCES OF DYNAMIC MAN By Mable Elsworth Todd Foreword by E G Brackett MD New York and London Paul B Hoeber Inc, 1937

PSEUDOCYSTIS By George Davis Bivin Ph D and M Pauline Klinger MA Bloomington, Ind The Principia Press Inc 1937

OXFORD MEDICAL PUBLICATIONS THE ABDOMINAL SURGERY OF CHILDREN By Sir Lancelot Barrington Ward K CVO Ch M FRCS (Edin) FRCS (Eng) 2d ed London Oxford University Press 1937

THE PHYSIOLOGY OF THE KIDNEY By Homer W Smith, AB Sc.D M.S (Hon) New York Oxford University Press 1937

OXFORD MEDICAL PUBLICATIONS THE MANAGEMENT OF THE PNEUMONIAS FOR PHYSICIANS AND MEDICAL STUDENTS By Jesse G M Bullowa BA MD New York Oxford University Press 1937

SYNOPSIS OF GENITOURINARY DISEASES By Austin I Dodson MD FACS 2d ed St Louis The C V Mosby Co 1937



Painted by Thomas Lawrence

Engraved by William Bonley

John Alcorn

1764-1831

SURGERY

GYNECOLOGY AND OBSTETRICS

An International Magazine, Published Monthly

VOLUME 65

DECEMBER, 1937

NUMBER 6

THE PRIMARY POINT OF INFECTION IN TUBERCULOSIS OF THE HIP JOINT

C HOWARD HATCHER, M D, and DALLAS B PHEMISTER, M D, F A C S, Chicago, Illinois

TUBERCULOSIS of the skeleton practically always arises as a result of hematogenous spread of the disease from primary foci in other regions. In children, the primary tuberculous infection is usually in the lung and the tracheobronchial lymph nodes but sometimes the primary site is in the intestine and mesenteric lymph nodes or elsewhere. In adults, skeletal tuberculosis may in some patients develop by hematogenous spread of bacilli from an old primary complex of childhood, but more often there is evidence of an active or arrested adult type of pulmonary lesion. In this clinic, for example, 36 patients with skeletal tuberculosis which started in adult life showed roentgen evidence of active pulmonary tuberculosis in 14, probably inactive fibrotic or calcified lung lesions in 9, calcified primary infections in 6, and no evidence of pulmonary tuberculous infection in 7. A joint in a relatively small percentage of cases becomes secondarily involved by extension from tuberculosis of surrounding structures such as bursæ, tendon sheaths, and other joints. Tuberculous bursitis about the hip, the knee, and in the hand has been known to involve the adjacent joints and tenosynovitis of the hand and foot has extended to the neighboring joints. Tuberculosis of the tarsal and carpal joints frequently spreads to other

neighboring joints as, for example, subastragalar tuberculosis which involves the ankle by direct extension or tuberculosis of the proximal tibiofibular joint which gives rise to infection of the knee. In the great majority of cases, however, the joint becomes involved by organisms that localize from the blood stream either in the synovia or in the neighboring bone. The location of the primary point of involvement of the joint structure is variable. When the primary focus is in the bone, it may be either in the epiphysis or in the diaphysis. There exists as yet no accurate estimate of the relative frequency with which the synovia, epiphysis, and diaphysis are primarily involved and there is variation in relative frequency of primary involvement of the various joint structures according to age and the joint under consideration.

This study is concerned with the primary point of involvement of the hip joint in tuberculosis beginning in both childhood and adult life. Either the synovia or the innominate bone or the upper end of the femur including the capital and trochanteric epiphyses and their metaphyses may be the primary site. A few instances in which tuberculosis of the gluteal and iliopectoral bursæ has spread to involve the hip joint have been reported. Evidence as to the primary site of the joint disease may be obtained by means of roentgenological and

From the Department of Surgery The University of Chicago

pathological examinations. The great advantage of the roentgen ray is that it can be employed early in the disease at which time it may disclose the primary focus, if osseous and subsequent examinations may show the extension to other structures of the joint. Pathological examination on the other hand may disclose primary synovial involvement or small osseous foci which are not recognizable in roentgenograms. As the disease advances and bone destruction progresses, it usually becomes increasingly more difficult from a single roentgenological or a pathological examination to determine accurately the primary point of involvement of the joint structure. Extensive bone destruction about the joint may be due either to increase in size of the primary bone focus or to secondary involvement by extension from the tuberculous arthritis. In advanced cases it is often impossible to determine the primary point of infection. It is sometimes true that a greater extent of involvement of the bone on one side of the joint results from primary localization in that bone but more frequently extensive bone destruction is the result of secondary invasion from the joint.

The material studied in this report comprises 82 case reports of patients who suffered from tuberculosis of the hip. In 70 of them the disease began in childhood and in 12 it began in adult life. The studies were made at extremely variable times after the onset of the disease and extended over variable periods of time in each case. This made a great deal of individual difference in the accuracy with which the primary point of infection could be determined. Also it should be borne in mind that the treatment varied considerably in the individual cases, which accounts for some of the variations in the pathological and roentgenological pictures obtained.

PRIMARY POINT OF INFECTION OF HIP JOINT IN CHILDHOOD

Primary osseous lesions of tuberculosis were more often seen about the hip in children than in adults. The reason for this is probably that during growth the bones about the joint receive a proportionately larger blood supply than is the case after growth has ceased. An

other factor is the existence of end arteries in the metaphyses, as has been demonstrated by Nussbaum (2). From the standpoint of primary localization, the 70 cases of hip joint tuberculosis which occurred in childhood are grouped as follows:

Location	No. of cases
Neck of femur	14
Ilium	13
Ischium	2
Capital femoral epiphysis	0
Uncertain	41

Primary focus in the femur. The justa-epiphyseal region of the neck of the femur was the most common site of primary osseous involvement in the series. Many of the lesions broke into the joint early but others apparently remained localized in the femoral neck for a relatively long time. Sometimes sufficient growth took place at the capital epiphyseal cartilage to bring the focus into the distal portion of the neck or the intertrochanteric region. Seven of the 14 patients were seen before there was definite clinical or roentgenological evidence of joint change. Repeated roentgenograms over a period of time, however, showed definite changes in the articular surfaces in all except 2 of the patients. The following case reports illustrate the primary focus in the neck with secondary arthritis.

CASE 1. D. M. female aged 7 years had pain in the hip for 6 months and on examination had very slight limitation of motion. Figure 1 a shows an area of rarefaction in the inferior justa-epiphyseal region of the neck. The inferior cortex of the neck is eroded and a slight shadow of superincumbent new bone is present. The shadows of the bony articular cortices of the head and acetabulum are intact and the cartilage space of the joint is of normal width. Immobilization of the extremity in a plaster hipnica cast with bed rest and a general anti-tuberculous regimen were carried out. There was improvement in the patient's general physical condition and a roentgenogram (Fig. 1 b) taken 4 months after entry shows signs of healing of the primary osseous lesion. After 7 months however the child was losing weight and there were daily temperature rises to 38 to 39 degrees C. The roentgenogram which was taken at this time (Fig. 1 c) shows definite spread throughout the joint as evidenced by the loss of shadows of the bony articular cortices of the femoral head and acetabulum. Marked atrophy of the bone almost obscures the primary metaphyseal lesion. At operation a tuberculous synovitis was found. The articular cartilages were extensively eroded and loosened from the underlying bone. In the inferior region of

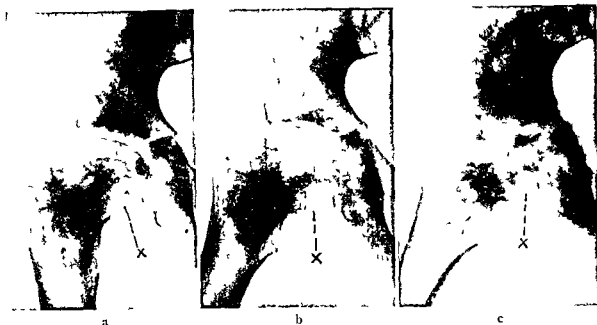


Fig 1 Case 1 Primary focus of tuberculosis in the neck of the femur a taken 6 months after onset shows an area of reduced density x in the inferior juxta epiphyseal region of the femoral neck—the shadows of the bony articular cortices and the articular cartilage space are normal, b, taken 4 months later, shows evidence of slight healing of the osseous focus with still no evidence of joint destruction c, taken after 7 months, shows marked regional atrophy loss of the shadows of the bony articular cortices, and a narrowed articular cartilage space, the primary neck focus is indistinct because of marked atrophy

the neck there was a cavity 1 centimeter in diameter which extended through the epiphyseal cartilage and into the capital epiphysis. Excision of the articular cartilages of the hip joint, curettage of the focus in the neck, and arthrodesis by full thickness tibial bone transplants were done. A sinus followed operation, the transplants had to be removed and 1 year later

there was still no bony ankylosis but also no further spread of the disease.

CASE 2 A K, male, aged 7 years, had pain and limp in the right hip for 2 years. The hip joint was freely movable. Figure 2, a, shows a large area of reduced density in the mesial portion of the neck. The cartilage space and the shadows of the bony

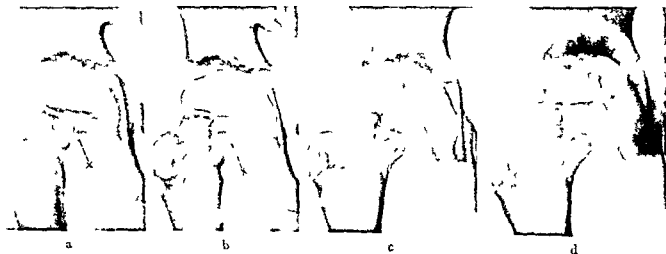


Fig 2 Case 2 Tuberculosis of the hip primary in the neck of the femur a, shows area of reduced density, x, in the mesial portion of the metaphysis a slight shadow of overlying periosteal bone, intact shadows of the bony articular cortices and the normal cartilage space of the joint, b taken 11 months after curettage shows bony repair of the osseous focus, c, taken 2 years after operation, shows

further healing of the primary focus but there are narrowed articular cartilage space an irregular loss of the shadows of the bony articular cortices, and a lateral erosion of the capital epiphysis which indicates tuberculous arthritis, d taken 8 months later, shows slight flattening of the capital epiphysis and slight sclerosis about its lateral area of erosion

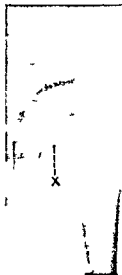


Fig 3 a

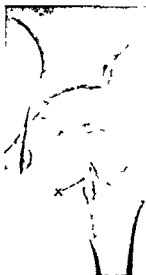


Fig 3 b



Fig 3 c



Fig 3 d



Fig 4

articular cortices show no change. Because of the absence of definite evidence of general involvement of the joint, operation to eradicate the primary bone lesion was done. The neck focus was tunnelled into laterally from beneath the greater trochanter and

Fig 3 Case 3. Tuberculosis of the hip primary in the femoral metaphysis. **a**, taken 6 months after onset, shows a triangular area of reduced density. **x**, mesially in the neck a normal cartilage space of the joint and normal shadows of the bony articular cortices. **b**, taken 1 1/2 years later, shows displacement of the primary metaphyseal focus to the mesial portion base of the neck and flattened capital epiphysis. **c**, taken 7 months later, shows loss of the shadows of the bony articular cortices and narrowed articular cartilage space which indicate tuberculous arthritis. **d**, taken 5 months later, shows loss of the bony shadow of the capital epiphysis and ilium over the superior portion of the joint.

Fig 4 Case 3. Photomicrograph showing necrotic articular cartilage **a** undermined and invaded by subchondral non-specific granulation tissue **b** which has absorbed the bony articular cortex and the subchondral cancellous bone (X, X).

tuberculous granulation tissue was curetted out with out opening into the joint. A plaster dressing has now been worn for 3 years and 4 months since operation. **Figure 2 b**, taken 11 months after operation, shows repair of the neck lesion and still no signs of general joint destruction. However at 18 months there was some irregular destruction of the bony articular cortices and narrowing of the articular cartilage space indicative of a spread into the joint. A roentgenogram taken 2 years after operation (**Fig 2 c**) shows further narrowing of the cartilage space and erosion of the lateral non-contacted portion of the head of femur. Two years and 8 months after operation (**Fig 2 d**) there is evidence of slight flattening of the head and sclerosis of the margins of the destructive areas on its lateral and medial portions. Despite fairly early surgical eradication of the neck focus the hip joint later showed signs of progressive involvement by the tuberculous process.

CASE 3 J. G. aged 4 years had pain and limp in the left hip for 2 years. Examination showed marked muscle spasm. **Figure 3 a**, taken 6 months after



Fig 5 Case 4 Primary osseous focus in the femoral neck. a shows a central juxta epiphyseal region of reduced density x , but no evidence of joint involvement, b, taken after 17 months, shows distal extension of the primary focus in the neck, c, taken after $3\frac{1}{2}$ years, shows an almost healed neck lesion and an intact joint

onset shows a triangular area of reduced density in the mesial one third of the femoral neck with its base bordering on the epiphyseal line. The cartilage space of the joint is of normal width and the shadows of the articular cortices are intact. A roentgenogram taken on admission (Fig 3, b) $1\frac{1}{2}$ years later shows continued growth of the femoral neck with displacement of the focus to the mesial portion of its base and blotchy increase in the density of the focus indicative of bony repair. The head shows signs of flattening but there is little if any narrowing of the cartilage space or reduced density of the articular cortical shadows. Biopsy of the synovia showed tuberculosis by microscopic and guinea pig tests. Treatment consisted of plaster encasement for 11 months and 3 weeks despite which there was progressive destruction of the joint. The sclerosed area of primary involvement in the neck had been further displaced distally. Figure 3, c, shows the loss of the shadow of the articular cortices and narrowing of the cartilage space after 7 months, and Figure 3, d, shows the loss of bone in the head and ilium along the upper portion of the joint 5 months later. Operation was then performed. There was extensive tuberculous synovitis. The head was flattened and reduced in size and its articular cartilage was largely intact but loosened. The joint was resected including the small head and underlying epiphyseal cartilage disc, and whole thickness tibial bone transplants were introduced. A microscopic section (Fig 4) of the head shows the articular cartilage to be necrotic and undermined by granulations consisting of round cells, fibroblasts and some necrotic debris, but containing no tubercles. The bone in the epiphysis had been extensively worn down from the surface but the re-

maining deeper portion to the epiphyseal cartilage disc was alive and showed no sign of tuberculous invasion.

In regions other than the hip, healing of a metaphyseal or diaphyseal focus of tuberculosis without joint involvement is observed occasionally. Foci in the distal femoral and the tibial metaphyses have been observed to heal spontaneously or after surgical eradication, leaving the neighboring joints uninvolved. In spina ventosa, the adjacent joints are rarely involved and healing is usual. At the hip, however, metaphyseal lesions which are large enough to be recognizable in roentgenograms usually spread to the joint. Approximately two thirds of the femoral neck is separated from the joint by only the thin covering of periosteum and reflected capsule so that infection in the neck can readily gain access to the joint. The common marginal localization of the primary focus in the metaphysis also favors extension into the joint. In 2 patients the central location of the lesion, which healed without progressive joint involvement, was probably of importance in the sparing of the joint. Spontaneous extracapsular drainage of the tuberculous abscess in 1 patient was also probably a factor in keeping



Fig 6. Case 1. Primary osseous tuberculois of the neck of the femur with sparing of the joint. a shows a central area of rarefaction (x) in the neck, a flattened and irregular capital epiphysis of greater density centrally than peripherally, and a shadow of slight periosteal bone formation laterally on the femoral shaft. b taken 6 months later shows distal extension of the metaphyseal focus and loss of

the bony shadow centrally in the femoral head. c, taken after 3 1/2 years, shows evidence of marked healing. The capital epiphysis is flattened but is more regular in contour and there is partial lateral dislocation. d, taken 7 years after the onset of symptoms, shows a flattened capital epiphysis of uniform density and bony repair of the primary neck focus.

the joint free of tuberculois. In the following case a central juxta epiphyseal lesion of the femoral neck healed without evidence of arthritis.

CASE 4. R. L. male, aged 5 years, had pain in the left hip for 9 months associated with night cries. Examination showed unrestricted motion at the hip. A skin tuberculin test was positive to 1:1000 old tuberculin. Figure 5, a, shows a central juxta epiphyseal area of reduced density in the neck metaphysis. The articular cartilage space is undiminished and the epiphysis is of normal contour and density. Treatment consisted of immobilization in plaster dressings for 2 years. A roentgenogram taken after 17 months (Fig 5, b) shows some distal extension of the focus in the neck but there is no evidence of general involvement of the joint. Three and one half years after the first examination there were no symptoms and free motion was present at the hip. Figure 5, c, shows the intact joint and slightly widened femoral neck with small areas of rarefaction which represent the almost healed focus which has become displaced downward in the neck by growth from the capital epiphyseal disc.

Since there was no tissue examination in this case the diagnosis of tuberculois was not proved. The symptoms, positive tuberculin test, and roentgenographic characteristics of the lesion, however, make a diagnosis of tuberculois by far most likely.

The following case is one of proved metaphyseal tuberculois in which roentgenograms taken over a period of 7 years showed no progressive destruction of the joint, and biopsy showed no tuberculous synovitis. Epiphyseal

changes were present and were indicative of either extension of the tuberculous infection to its bony center or possibly interference with the blood supply followed by necrosis with subsequent regeneration.

CASE 5. T. C. female, aged 2 years, had pain in the left hip for 4 months. Examination showed tenderness about the hip but motion was only slightly restricted. Apiration of the joint yielded no fluid. Figure 6, a, shows a large central area of reduced density in the femoral metaphysis which borders on the epiphyseal cartilage and extends down the neck to the intertrochanteric region. The bony center of the capital epiphysis is irregular and flattened and of greater density centrally than peripherally. The cartilage space of the joint is of normal width. A shadow of slight periosteal bone formation is present on the lateral aspect of the femoral shaft. A diagnosis of tuberculous focus in the femoral metaphysis with secondary involvement of the bony center of the head was made and plaster immobilization of the hip joint was carried out for 7 years. After 6 months a cold abscess was found to be present anteriorly in the thigh and this spontaneously opened just above the knee. Guinea pig inoculation showed tuberculois, and granulations from the sinus were microscopically tuberculous. A roentgenogram (Fig 6, b) taken after 20 months shows extension downward of the metaphyseal lesion to the lower level of the lesser trochanter and extensive loss of the bony shadow in the femoral head. There is no narrowing of the cartilage space of the joint and the cortex of the acetabulum shows no change. There is slight lateral displacement of the head of the femur. Another roentgenogram (Fig 6, c) taken 3 1/2 years after the



Fig 7 Case 6 Tuberculosis of the hip primary in the neck of the femur a, shows a diffuse area of rarefaction x , in the metaphysis which contains smaller shadows of bone of greater density than the surrounding atrophic bone a slight loss of the shadow of the bony articular cortex at the lateral margin of the femoral head but an undiminished cartilage space of the joint, b taken 1 year later shows non union of the tibial transplants to the femur and partial healing of the neck focus, c taken 2 years after the second transplant was done, shows solid fusion of the joint and healing of the neck focus

first examination shows evidence of marked healing of the metaphyseal focus The bony center of the epiphysis is flattened but is more regular in contour and the central area of rarefaction is decreased in size in comparison with the previous roentgenogram The hip is partially dislocated but there is no roent-

gen evidence of progressive tuberculous involvement of the joint Biopsy of the hip joint was then performed The articular cartilages were grossly normal Microscopically the synovia showed no evidence of tuberculosis and guinea pig inoculation was negative Seven years after the onset of symptoms the hip

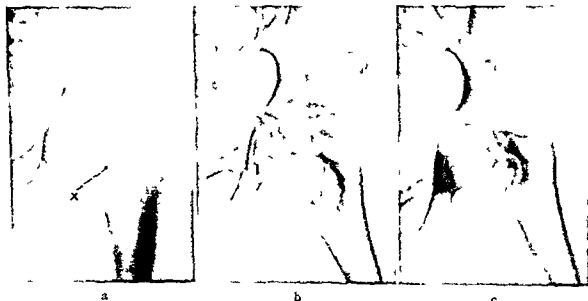


Fig 8 Case 7 Tuberculosis of the hip primary in the neck of the femur a shows area of bone absorption x in the inferior region of the neck surrounding the sequestrum, erosion of the inferior cortex of the neck, an articular cartilage space of normal width a capital epiphysis that is atrophic but is of normal contour, the presence of lamellar shadows of periosteal new bone laterally on the diaphysis b taken 1 year later shows sclerosis of the margins of the primary focus, a diminution in the size of the sequestrum but a narrowed articular cartilage space and indistinct shadows of the bony articular cortices which indicate joint invasion, c taken after 2 years shows invasion and destruction of the opposing regions of the ilium, capital epiphysis and metaphysis

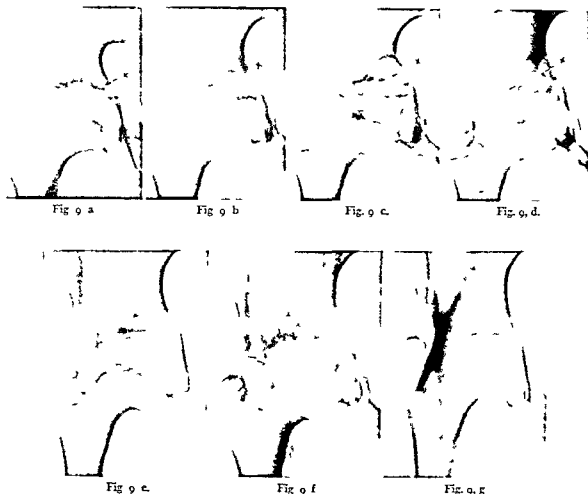


Fig. 10

Fig. 9. Case 8. Tuberculosis of the hip primary in the ilium. a, shows area of reduced density x, in the ilium near the joint and 1-cm. of the acetabulum, normal articular surfaces. b, taken 1 year later shows the increased size of the osseous focus, destruction of the neighboring bony articular cortex of the acetabulum, and a slightly flattened capital epiphysis. c, taken after 3 years, shows marginal sclerosis about the enlarged bony lesion. d, taken after 6 years, shows a large area of reduced density in the ilium with smaller flecks of greater density within it. There is a shadow of intact bony articular cortex over the lateral one third of acetabulum and over the slightly flattened femoral head but loss of it over the involved region of the acetabulum. e, Taken 11 months after eradication of the primary focus in the ilium, shows filling in by bone and no additional evidence of joint destruction. f, taken 4 months later shows further narrowing of the articular cartilage space and lateral and mesial erosion of the capital epiphysis which indicates active tuberculous arthritis. g, taken 4 months after operation, shows union of the bone transplants with ankylosis.

Fig. 10. Case 8. Photograph of resected articular surface of the head of the femur showing relatively well-preserved articular cartilage x over the superior portion.

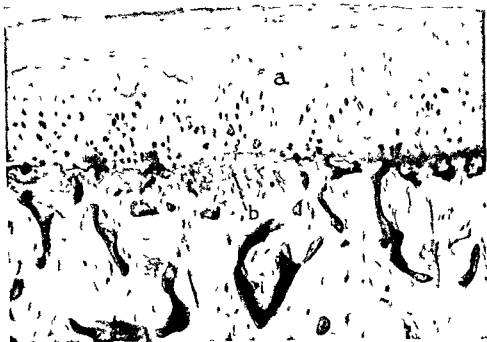


Fig 11 Case 8 Photomicrograph of the lateral region of the superior articular surface of the femoral head showing necrotic cartilage, *a*, partly separated from the underlying bone by subchondral granulation tissue, *b*, which has largely destroyed the bony articular cortex ($\times 225$)

joint was freely movable Knee flexion was markedly limited due to scarring of the quadriceps muscle about the healed sinuses The roentgenogram (Fig 6, d) taken then shows complete replacement of the flattened capital epiphysis by bone of uniform density and bony repair of the primary neck lesion without evidence of joint destruction

The character of the metaphyseal lesions varied in the different cases and at different stages of the disease In 10 cases of Group I, the primary lesion was located in the inferior juxta-epiphyseal region as illustrated in Cases 1, 2, and 3, and appeared in the roentgenograms as a local area of reduced density, sometimes with smaller shadows of relatively greater density which represented small sequestra In the following case the neck lesion was more diffuse and evidence of general involvement of joint structure appeared early

CASE 6 B C, male, aged 11 years, had slight pain in the right hip for 5 months On examination it was found that motion of the hip was restricted to about half of the normal range Figure 7, a, shows diffuse rarefaction in the metaphysis within which appear smaller shadows of greater density than the surrounding atrophic bone There is also slight marginal loss of the shadow of the bony articular cortex of the femoral head but the cartilage space is undiminished

At operation curettement of the metaphyseal lesion and arthrodesis of the hip with tibial bone grafts were done Tuberculous synovitis was found to be present Openings in the superior cortex of the femoral neck led to the bony focus from which tuberculous granulation tissue and many small bone sequestra were curetted Microscopic examination of the articular cartilage at the lateral margin of the femoral head showed it to be undermined and its bony articular cortex broken down by non tuberculous granulations Roentgenograms taken 1 year later (Fig 7, b) show non union of the tibial grafts to the femur A portion of the primary focus is still evident in the femoral neck A second operation was done, at which time the articular cartilages were excised and massive tibial grafts were placed across the joint Bony fusion was present 4 months later A roentgenogram (Fig 7, c) made 23 months after the second operation shows solid fusion of the joint and healing of the metaphyseal focus

In another case, severe tuberculous infection of the metaphysis resulted in a large bony sequestrum which underwent slow and incomplete absorption over a period of 2 years A large tuberculous abscess formed early in the disease and regional diaphyseal periosteal bone formed early but disappeared with subsidence of active infection Healing of local bony lesion evidenced by development of marginal sclerosis and by some filling in by bone

CASE 7 R R Mexican male, aged 2 years and 6 months had pain in the left hip for 4 months and swelling of the upper thigh for 2 weeks. Examination showed marked muscle spasm at the left hip and a fluctuant mass located laterally in the upper part of the thigh. A skin tuberculin test was positive 1:10,000 old tuberculin. Figure 9 a shows an area of bone absorption in the inferior portion of the femoral neck surrounding a large separated bony fragment which is of greater density than the adjacent living bone. The inferior cortex of the femoral neck is destroyed. The articular cartilage space is of normal width and the bony center of the capital epiphysis is reduced in density but has its normal contour. Lamellar shadows of periosteal new bone are present along the lateral aspect of the proximal half of the diaphysis. A diagnosis of metaphyseal tuberculosis with secondary arthritis was made and treatment by immobilization of the hip, bed rest, and general antituberculous care was carried out. A roentgenogram (Fig 9 b) taken 1 year after the first examination, shows some sclerosis of the bone about the large metaphyseal focus and diminution in the size of the sequestrum. The articular cartilage space is slightly narrowed and the shadows of the articular cortices are indistinct. The shadow of periosteal new bone along the diaphysis which was present at the first examination is no longer seen. Although the child's physical condition improved, the roentgenogram taken 1 year later (Fig 9 c) shows invasion and destruction of opposing regions of the ilium, capital epiphysis and metaphysis. The primary osseous focus in the inferior portion of the neck shows evidence of healing. The sequestrum in the center of the focus is very small.

Primary focus in the ilium In childhood the articular cartilages of the acetabulum and the Y shaped cartilage contribute by enchondral bone formation to the growth of the innominate bone. In regions of active enchondral ossification there is a relatively abundant vascular supply so that lodgment of infected emboli from the circulation is favored. In 10 child patients with tuberculosis of the hip, the primary focus was identified in the ilium bordering on the acetabulum. In 3 of these the early roentgenograms showed the presence of the osseous focus before showing evidence of general involvement of the joint. One of them a 7 year old male, known to have been heavily exposed to tuberculous infection, was recently observed 1 week after the onset of pain about the hip. Roentgen examination at that time disclosed no definite evidence of a bone lesion. A roentgenogram taken 2 weeks later, however, showed an area of reduced density in the ilium bordering on the acetabulum and

the Y shaped cartilage with a shadow of regional periosteal new bone on the mesial surface of the ilium but no evidence of arthritis. Thorough curettage of this focus without entering the hip joint has been followed by subsidence of symptoms and at this time, 16 months after the operation, there is no evidence of hip joint involvement. In the patient whose case report follows the bone lesion was present for approximately 7 years before there was appreciable evidence of breaking down of the joint.

CASE 8 F W male, aged 12 years, had pain in the right hip for 6 years. The early roentgenogram (Figure 9 a) shows a small area of reduced density in the ilium bordering on the acetabulum and the Y shaped cartilage. Treatment had consisted in plaster encasement of the limb. A roentgenogram taken 1 year later (Fig 9 b) shows increase in the size of the osseous focus in the ilium with destruction of the neighboring bony articular cortex of the acetabulum. The capital epiphysis is slightly flattened but the cartilage space is normal. A roentgenogram (Fig 9 c) taken 3 years later shows some increase in the size of the iliac lesion and sclerosis of its margins but no further evidence of joint destruction. On entry 6 years after the onset of symptoms examination showed the hip only slightly limited in motion. The roentgenogram taken at this time (Fig 9 d) shows the large area of decreased density in the ilium with sclerotic borders and small irregular flecks of greater density. The shadow of the articular cortex is absent over the involved portion of the acetabulum but it is intact over the lateral one third and over the somewhat flattened femoral head. The cartilage space of the joint is slightly narrowed. Because of the absence of symptoms of active arthritis and the absence of definite roentgen findings of general involvement of the hip joint an operation was done in which the muscles were reflected from the mesial surface of the ilium at the level of the anterior inferior iliac spine and the primary lesion was exposed through a window and curetted out. The cavity which measured 2 by 3 centimeters contained tuberculous granulations and pus. Its inferior wall was the acetabular roof but no opening into the hip joint could be demonstrated. The operative wound healed without the formation of a sinus. The hip was immobilized in plaster for 7 months and then motion without weight bearing was permitted for 4 months. A roentgenogram (Fig 9 e) taken at the end of this time shows almost complete filling in of the iliac lesion by bone and no additional evidence of general hip joint involvement. The patient was then allowed to walk. Fifteen months after the operation however there was increasing pain and stiffness of the hip and additional roentgenograms (Fig 9 f) show further decrease in the cartilage space and lateral and medial erosion of the capital epiphysis. Active

Fig 12 Case 9 Tuberculosis of the hip primary in the ilium a Fourteen months after onset Area of reduced density x is present in the lateral portion of the ilium bordering on the acetabulum The articular cartilage space is of normal width The shadows of the bony articular cortices of the head and mesial portion of the acetabulum are intact b Ten months later There is collapse of the acetabular roof with partial dislocation of the head of the femur and a spur of bone, s , from the ilium above the head, also a reduced cartilage space of the joint and a loss of the shadow of the bony articular cortex over the superior region of the capital epiphysis

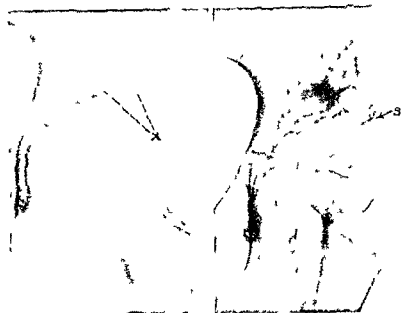


Fig 12 a

Fig 12, b

Fig 13 Case 10 Tuberculosis of the hip primary in the ischium a Area of reduced density x , in ischium near the y cartilage, no evidence of general involvement of the joint b Two years later Loss of the articular cartilage space and the shadows of the bony articular cortices partial dislocation and secondary invasions of the ilium y , and the head the primary ischial focus is now obscured

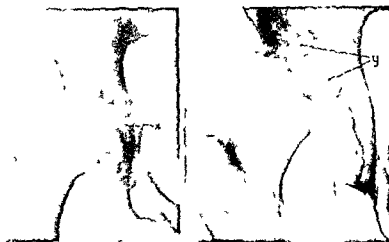


Fig 13, a

Fig 13, b

tuberculosis of the hip joint was diagnosed and resection of the articular cartilages and arthrodesis by tibial bone transplants were done The joint cavity about the femoral neck was found obliterated by adherent tuberculous synovia and the articular cartilage of the acetabulum was thinned but that of the head was relatively well preserved (Fig 10) The joint had probably been involved early by a mild tuberculous process which was quiescent during the years of immobilization and was reactivated by the recent weight bearing A photomicrograph (Fig 11) of the lateral portion of the articular surface of the capital epiphysis shows the articular cartilage to be intact superficially but invaded and partially separated from the underlying bone by subchondral non-specific granulation tissue which has broken down and has absorbed the bony articular cortex Four months after operation there was bony ankylosis of the hip (Fig 9, g)

In another case an iliac focus of tuberculosis was present before there was roentgen evidence of joint destruction, but extension soon resulted in an extensive breakdown of joint structures

CASE 9 L K, female, aged 7 years, had limp for 2 years with increasingly severe pain Figure 12, a, taken 14 months after onset of symptoms, shows an area of reduced bone density in the lateral portion of the ilium bordering on the acetabulum The shadow of the articular cortex of the acetabulum is intact except at the lateral margin where it is indistinct That of the femoral head is normal except for regional atrophy, and the cartilage space is normal On hospital entry 10 months later there was markedly restricted motion of the hip A roentgenogram (Fig 12, b) taken then shows breaking down of the ace



Fig 14 a

Fig 14, b



Fig 15 a

Fig 15, b



Fig 16 a

Fig 16 b

Fig 14 Case 11 Primary metaphyseal tuberculosis with secondary extension into the capital epiphysis and the joint. a Area of reduced density \times mesially in the neck and extending into the capital epiphysis moderate coxa vara narrowed cartilage space of the joint and indistinct shadows of the bony articular cortices indicating joint involvement. b Two years after resection of the articular surfaces and transplantation of the tibial bone. There is union of the transplants but the joint line is in completely filled in by bone.

Fig 15 Case 12 Secondary invasion of the capital epiphysis and ilium in tuberculous arthritis. a Taken 5 years after onset shows area of rarefaction γ in the capital epiphysis area of rarefaction and sclerosis z in the opposing ilium a slightly narrowed cartilage space and reduced shadows of the bony articular cortices. b Taken 2 years and 9 months after arthrodesis shows areas of secondary invasion healed.

Fig 16 Advanced tuberculosis of the hip with partial growth arrest. a Shows destruction in the ilium capital epiphysis and neck of the femur with shadows in the head and neck of greater density than the surrounding atrophic bone small osseous center of greater trochanter t . b Taken 3 years later shows further destruction and upward displacement of the greater trochanter through the longitudinal growth of its epiphyseal cartilage disc.

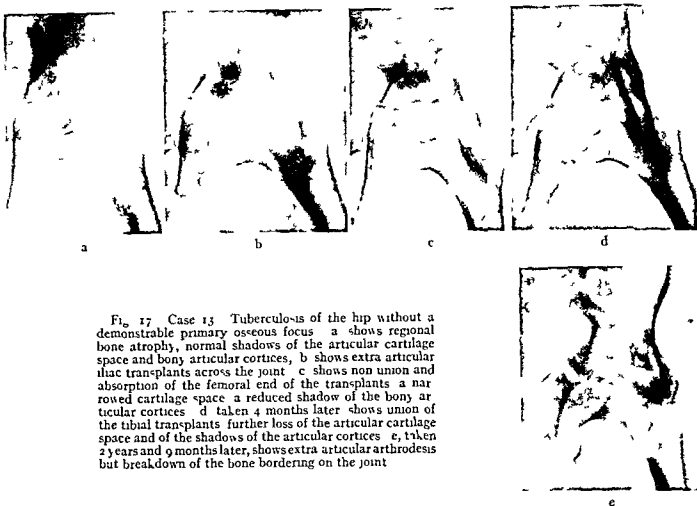


FIG. 17. Case 13. Tuberculosis of the hip without a demonstrable primary osseous focus. a shows regional bone atrophy, normal shadows of the articular cartilage space and bony articular cortices. b shows extra articular iliac transplants across the joint. c shows non union and absorption of the femoral end of the transplants. a narrowed cartilage space. a reduced shadow of the bony articular cortices. d taken 4 months later shows union of the tibial transplants. further loss of the articular cartilage space and of the shadows of the articular cortices. e, taken 2 years and 9 months later, shows extra articular arthrodrosis but breakdown of the bone bordering on the joint.

tabular wall and partial dislocation of the femoral head into the area of iliac bone destruction. A spur of periosteal bone has formed lateral to the iliac lesion. The articular cartilage space is hazv and decreased and the shadow of the bony articular cortex is blurred over the superior central region of the capital epiphysis which is opposed to the iliac cavity.

At operation excision of the iliac focus and arthrodrosis of hip were done. A tuberculous abscess was found under the psoas muscle. A cavity 2.5 centimeters in diameter in the ilium just above the acetabulum was found to extend into the joint through a perforation in the acetabular cartilage. Tuberculous synovitis was found to be present. The head of the femur which was partially dislocated was covered by articular cartilage which was thinned superiorly. The acetabular articular cartilage was markedly thinned. The articular cartilage of the acetabulum was curetted away and that of the femoral head was excised in such a way that the epiphyseal cartilage disc between it and the neck was not injured. The bony epiphysis was placed in contact with the denuded ilium and an iliac bone transplant was placed from the epiphysis to the ilium. Solid fusion was present after 9 months of cast immobilization. Microscopic examination of sections through the excised cartilage of the femoral head shows destruction of the

bony articular cortex by non tuberculous granulation tissue. No tuberculous tissue was found in the epiphyseal bone although there was extensive tuberculous synovitis.

Primary focus in the ischium. Primary tuberculous involvement of the ischium with secondary extension into the hip joint was observed in 2 childhood cases. In each of these, roentgenograms made early in the course of the disease showed an area of ischial bone destruction bordering on the Y-shaped cartilage of the acetabulum without evidence of extensive involvement of the rest of the joint. Subsequent roentgenological and pathological examination showed signs of extensive tuberculous arthritis with secondary bone invasions which obscured the point of primary ischial involvement. The following is 1 of the 2 cases.

CASE 10. W. W., male, aged 13 years, had pain in the right hip and limp for 2 years. Figure 13, a, taken 6 months after the onset of symptoms shows an area of reduced density in the ischial portion of the acetabu-



Fig. 18. Advanced tuberculosis of the hip with extensive secondary invasion and absorption in the innominate bone and loss of the head and part of the neck of the femur. Primary point undetermined.

lar wall near the triangular cartilage. The shadows of the bony articular cortices and the articular cartilages are normal. At entry 2 years after the initial symptoms there was limitation of hip joint motion to one half normal range. In the roentgenogram taken at this time (Fig. 13, b) there is extensive joint involvement as evidenced by a loss of the shadows of the bony articular cortices, subluxation, marked thinning of the cartilage space and extensive secondary invasion and absorption in the ilium and the capital femoral epiphysis. At this time it would be impossible to identify the ischial change as the primary focus.

At operation extensive tuberculous synovitis was found. The articular cartilages were thinned and loosened from the underlying bone. The cartilages were excised and full thickness tibial transplants were placed across the joint. Healing occurred but there was subsequently some absorption of the bone grafts and solid fusion was not present until 3 years after the operation.

Epiphyseal changes in childhood tuberculosis of the hip. In no instance of childhood tuber-

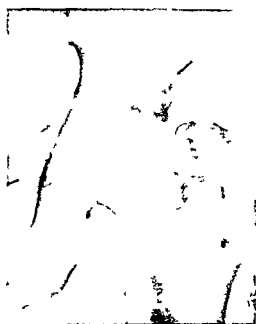


Fig. 19. Case 14. Tuberculosis of the hip in an adult primary in the greater trochanter. The roentgenogram shows irregular rarefaction of the trochanter, a narrowed cartilage space of the joint, loss of the shadow of the bony articular cortex of the femoral head and reduction of its shadow on the acetabulum.

culosis of the hip was there evidence either in the roentgenograms or in the pathological specimens of a primary focus in the capital femoral epiphysis. The comparatively early destruction of the articular cortex as revealed by the reduction or loss of its density in the roentgenograms was found on microscopic examination to be due to the action of microscopically non-specific granulation tissue. This subchondral tissue composed of fibroblasts, numerous capillaries, round cells, and occasional foreign body multinucleated cells, apparently develops by proliferation of the vascular fibrous tissue normally present beneath the articular surfaces. It appears early in tuberculous arthritis but is not directly connected with the proliferating tuberculous synovia as shown by its presence while the cartilage covering of the head is still superficially intact. Although histologically non-tuberculous its peculiar action in breaking down the bony articular cortex with loosening and slow invasion of the articular cartilage makes it a characteristic pathological feature of tubercu-

Fig 20 Case 15 Tuberculosis of the hip in an adult, primary in the greater trochanter, secondary in the joint a, Taken 3½ months after fracture of the greater trochanter, shows union with an area of reduced density, x, in the lateral portion of the fracture line There is no evidence of joint involvement b, Taken 17 months later shows irregular reduction of density in the greater trochanter a narrowed articular cartilage space and loss of the shadows of the bony articular cortices which indicates tuberculous arthritis



lous arthritis Cases 3 and 8 illustrate the roentgenological and pathological characteristics of early epiphyseal changes due to subchondral absorption

The failure to find evidence of primary localization of tuberculosis in the capital femoral epiphysis in children corresponds with experience in other joints such as the knee and ankle where the primary point of involvement when osseous is usually metaphyseal in location (5) Likewise, experience in pyogenic arthritis of the hip during childhood has shown that primary osseous involvement is frequent in the neck of the femur and ilium but is rare in the capital epiphysis (3)

Secondary invasion of the epiphysis by tuberculous tissue occurred by direct extension of the primary neck focus through the epiphyseal cartilage disc and by invasion from active tuberculosis within the joint Epiphyseal involvement from a neck focus usually took place before there was extensive joint destruction and followed necrosis and absorption of a portion of the epiphyseal cartilage In some cases the entire bony epiphysis was secondarily involved while in others localized destruction with cavity formation resulted The following case is one of a primary metaphyseal localization of tuberculosis with secondary extension into the epiphysis and joint

CASE 11 W H male aged 8 years had limp and mild pain in the left hip for 6 years On examination there was found only slightly limited motion Figure 14, a, shows an area of reduced density in the inferior

region of the neck and epiphysis The articular cartilage space is only slightly reduced and the shadows of the bony articular cortices are lost and the bony margins are fuzzy There is moderate coxa vara and a bony bridge is present between the central portion of the capital epiphysis and metaphysis which suggests an earlier growth arrest

At operation, an extensive tuberculous synovitis was present A cavity containing granulations occupied the inferomedial portions of the metaphysis and epiphysis The articular cartilages were loosened from the underlying bone and in the region of cavitation the femoral articular cartilage was depressed The articular cartilages were removed and tibial transplants were placed across the joint Two years later there was a bony bridge from the ilium to the femur in the region of the transplants but the joint line was still incompletely filled in with bone (Fig 14, b)

In most of the advanced cases of tuberculous arthritis the capital epiphysis was secondarily involved by extension of tuberculosis from the joint This usually occurred late in the disease after the articular cartilages had been extensively absorbed, but sometimes localized areas of secondary invasion occurred before there was advanced joint destruction Such invasions usually produced necrosis and absorption of bone and left cavities not only in the capital epiphysis but also in the opposing acetabular bone The destruction of bone on both the femoral and pelvic sides of the joint and the failure to find such areas of epiphyseal bone destruction in the early stages of arthritis clearly indicated the secondary rather than primary nature of such lesions An example of secondary invasion of both the epi-



Fig. 21 Case 16 Secondary bilateral bone invasion in tuberculosis of the hip in an adult. The roentgenogram shows a narrowed cartilage space and loss of the shadows of the bony articular cortices except over the superior region of the joint where triangular shadows of greater density than the surrounding atrophic bone indicate the presence of kissing sequestra in the femoral head *y* and in the opposing ilium.

physal and acetabular bone which left opposing areas of bone absorption is furnished by the following case:

CASE 12 C C female aged 8 years had slight pain in the left hip for 5 years with more severe symptoms during the last year. On examination there was found slight restriction of joint motion. Figure 15 a shows the articular cartilage space to be narrowed and the shadows of the bony articular cortices are

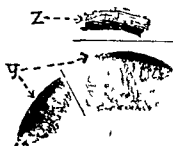


Fig. 23 Case 16 Roentgenogram showing a similar density of the bone in kissing sequestra in the head of the femur *y* and ilium *z*. The surrounding living bone in the femoral head is reduced in density.

fairly well marked over the superior portion of the joint but are diminished medially on both the acetabulum and the head. Opposing areas of rarefaction with sclerotic margins are seen in the ilium and the capital epiphysis.

At operation tuberculous synovitis was present. Microscopic sections of cartilage and bone removed from the superior portion of the joint showed under mining and absorption of the deep cartilage layers by granulations composed of fibroblasts, round cells and occasional foreign body multinucleated cells. Arthrodesis of the joint was done, full thickness tibial bone transplants being used. Bony fusion was present 6 months later. Figure 15 b, shows fusion 2 years and 9 months after operation with healing and bony repair of the areas of destruction. The cavity in the head of the femur in this patient approaches most nearly that which might be expected in a patient with primary involvement of the epiphysis. The 5 year duration of the disease, however, and the presence of a similar area in the opposing acetabulum make it clear that both lesions are secondary invasions.

Although tuberculous invasion of bone during childhood usually results in necrosis followed by complete absorption, there was in the case of an adolescent female a bilateral secondary invasion of tuberculosis from the joint which produced opposing sequestra which persisted in a manner commonly found in the tuberculous arthritis of adults.

Secondary bone invasions which occurred after the tuberculous arthritis was advanced frequently resulted in a gradual breakdown of the femoral head and acetabulum. The breaking down usually began in the superior portion of the femoral epiphysis and in the iliac portion of the acetabulum probably because of greater pressure on those opposing surfaces. The late roentgenograms in Cases 7 and 10



Fig. 22 Case 16 Photograph of the excised articular surfaces showing sequestra *y* in the femoral head exposed centrally but partially covered peripherally by necrotic cartilage, *c* iliac sequestrum *z* and acetabular articular cartilage *d*.

demonstrate this tendency to more advanced bone destruction at the points of pressure

Destruction of the cartilage disc between the capital epiphysis and neck resulted in arrested longitudinal growth through the neck. When this occurred in young children there was usually continued longitudinal growth for some time at the epiphysis of the greater trochanter resulting in its elevation above the level of the hip joint. This is demonstrated in Figure 16, a, which is a roentgenogram of a 3 year old child and shows extensive destruction in the ilium, the capital epiphysis, and the neck of the femur with irregular shadows in the head and neck which are of greater density than the surrounding atrophic bone which is indicative of sequestra. The small osseous center of the greater trochanter is atrophic but appears uninvolved. Figure 16, b, taken 3 years later, shows further destruction of the joint and upward displacement of the greater trochanter through longitudinal growth of its epiphyseal cartilage disc. The necrotic bony fragments of the head and neck have been almost completely absorbed except for small fragments which have become separated and displaced laterally and distally along the diaphysis. The capital epiphysis, epiphyseal cartilage disc, and metaphysis have been destroyed leaving only the distal portion of the femoral neck. In Case 11 (Fig 14) there was partial growth arrest at the mesial portion of the epiphyseal line between the head and neck resulting in moderate coxa vara.

Tuberculous arthritis of undetermined origin primary synovial tuberculosis. In 44 of the patients it was not possible to state the part of the joint structure in which the infection started. Nine of these were observed early in the course of the disease without finding evidence of a bone lesion which could be considered primary. Roentgenograms taken at later periods showed evidence of secondary bone invasion in most of them. The primary site of joint involvement in these patients may have been in the synovia but it is possible also that small osseous foci which were not detectable in the roentgenograms were present. The roentgenograms taken of the patient whose case report follows showed no evidence of an early osseous focus, and this may have been

primary in the synovia. Late invasion and destruction of bone on both sides of the joint is demonstrated.

CASE 13. H. E., male, aged 4 years, had pain in the left hip and knee for 4 months. Examination showed restricted motion at the left hip. Figure 17, a, shows slight regional bone atrophy but no evidence of joint destruction or of a primary osseous focus.

At operation biopsy of the joint and extra articular arthrodesis by iliac bone grafts were done, as shown in the roentgenogram (Fig 17, b). Microscopic sections of the synovia showed tuberculosis. Four months later there was non union of the bone grafts to the femur and at the end of 1 year they were absorbed at the femoral end as shown in Figure 17, c. Here the articular cartilage space is diminished and the shadows of the bony articular cortices are indistinct. A second operation was done placing full thickness tibial bone transplants from the ilium to the femoral neck and trochanter. The roentgenogram (Fig 17, d) made 4 months later shows union with the transplants, further loss of the articular cartilage space, and breaking down of the superior portion of the capital epiphysis. Two years and 8 months later there was solid ankylosis of the hip but the roentgenograms (Fig 17, e) taken then show advanced destruction of the superior region of the epiphysis, the neck, and to some extent the ilium. In this case late bone destruction took place although extra articular arthrodesis was accomplished.

In 36 patients, advanced destruction of the joint structures made it impossible to determine accurately either pathologically or roentgenologically the primary site of the joint involvement. It is logical to assume that earlier roentgen examinations of some of these patients would have disclosed primary osseous foci. Destruction more advanced on one side of the joint than on the other in some patients suggested that the primary involvement had been in the bone which showed the greater destructive lesion. This could not be depended upon in determining the primary site, however, for in several early cases followed through the course of the disease, as in Case 10, a small primary bone lesion later became obscured in the roentgenograms by massive secondary bone invasion in other parts. The major bone destruction frequently occurred in a region other than that of the primary site. Massive invasions of the innominate bone or of the femur were more commonly due to secondary extension from the joint than to increase in the size of a small primary lesion situated in

either bone. Usually when the bone on one side of the joint was extensively invaded secondarily the other side showed a corresponding degree of destruction. Secondary extension into the femur usually involved the capital epiphysis and adjacent neck but less often the base of the neck, shaft, or trochanter. An unusually extensive secondary invasion of innominate bone and destruction of the head and neck of the femur is shown in the roentgenogram (Fig. 18) of a 10 year old female who had had untreated tuberculosis of the hip joint for 7 years. This case illustrates well the impossibility of determining the primary point of joint involvement in the late stages of the disease. Isolated secondary invasions of the neck of the femur were not observed and the finding of a single destructive lesion in this location even late in the disease is good evidence that it was the primary site of infection.

TUBERCULOSIS OF THE HIP JOINT STARTING IN ADULT LIFE

In 9 out of 12 patients with tuberculosis of the hip which started in adult life, no demonstrable primary bone focus could be made out either roentgenologically or pathologically. Three primary bone foci were observed, 2 in the greater trochanter and 1 in the ilium above the acetabulum. The 2 primary lesions in the trochanter extended into the hip joint and produced extensive tuberculous arthritis. One of them developed following a fracture of the trochanter in an adult who had active pulmonary tuberculosis. The primary osseous lesion in the ilium occurred in an individual with active pulmonary tuberculosis and had not extended into the hip joint at the end of the second year. The following 2 cases were primary in the trochanter and extended secondarily to the joint.

CASE 14. M. D. male aged 45 years, had pain about the left hip for 5 years, stiffness for 2 years and swelling of the thigh for 1 year. Examination showed a large fluctuant mass located laterally in the upper thigh. Motion at the joint was limited and painful. The roentgenogram (Figure 19) shows marked destruction of the greater trochanter with displacement of its superior portion. The cartilage space of the joint is narrowed and the shadow of the bony articular cortex is lost over the femoral head and is diminished over the acetabulum. A di-

agnosis of tuberculosis primary in the trochanter and secondary in the hip joint was made and operation was done. A large abscess with sinuses leading into the partially destroyed trochanter was evacuated and the diseased bone cleaned out. Bone transplants were placed extra articularly from the ilium to the femoral shaft. Microscopic examination and guinea pig inoculation showed tuberculosis. Fourteen months later there was failure of fusion of the transplants to the femur and a second operation was done. The hip joint was entered and extensive tuberculous synovitis was found. The articular cartilages were found loosened from the subchondral bone. The articular surfaces of the top of the head and of the acetabulum were denuded and tibial transplants were placed across the joint. Abscesses and sinuses formed with later sequestration of the grafts which had to be removed. Marked infection persisted and 2 years later the patient died.

CASE 15. M. C. male aged 37 years, had had occasional pain in the left knee since the age of 16. Eleven years ago he sustained a T shaped fracture of the lower end of the left femur and following this he had symptoms of active tuberculosis of the left knee which was later excised and arthrodesed. Twenty months before entry the patient sustained a simple fracture of the left greater trochanter in an automobile accident. Solid union and good function were present after 8 months but 1 year after injury increasing stiffness and pain at the hip were noted. Figure 20 a shows early union of the fractured trochanter 3½ months after injury and an area of reduced density in the lateral portion of the old fracture line. The hip joint appears uninvolved at this time. At entry 17 months later there was marked restriction of motion at the hip and x ray evidence of an old active pulmonary tuberculosis. Figure 20 b shows irregular areas of reduced density in the greater trochanter, loss of the articular cartilage space and loss of the shadows of the bony articular cortices. A diagnosis of tuberculosis of the trochanter with secondary extension to the hip joint was made and operation of excision of the articular cartilages and arthrodesis with tibial transplants was done. An abscess in the trochanter was found and the material cleaned out. Microscopic examination revealed tuberculous granulation tissue. The articular cartilages were found loosened from the underlying bone and were markedly thinned. Bony ankylosis was present 14 months after operation.

In contrast to other joints such as the knee and ankle, primary epiphyseal foci located in the juxta articular region were not found in any of the tuberculous hips of adults. The femoral neck which was so frequently primarily involved in children was not the site of a primary osseous lesion in any of these.

Secondary bone invasion in adults. Secondary invasion of the femoral head and ilium in

tuberculosis of the hip joint in adults was relatively frequent. In 3 of the 12 adult patients, bilateral sequestra were found. These sequestra developed late in the course of active tuberculous arthritis and their bilateral nature indicated that they were the result of secondary invasions of bone, as reported by one of us (1), and were not primary foci resulting from embolism as reported by Koenig (1). Their location in the superior portion of the femoral head and in the opposed region of the ilium suggests that pressure played a role in their formation. The iliac sequestra were smaller than the opposing ones in the femur and extensive regional absorption of the ilium in 2 patients left cavities in which the sequestra lay. In the femoral head the sequestra were loosened from the surrounding living bone but extensive absorption of the necrotic bone did not take place. Secondary bone invasion with formation of kissing sequestra is illustrated in the following case:

CASE 16. R. R. male, aged 20 years, had limp and pain in the left hip for 11 months. Figure 21 shows narrowing of the articular cartilage space and loss of the shadows of the bony articular cortices over the mesial portions of the head and acetabulum. In the superior portion of the femoral head there are two triangular shadows of density greater than the surrounding bone, almost separated from each other by a V shaped notch and from the underlying bone by a narrow zone of reduced density. The articular surfaces of the more dense areas are sharply defined. In the opposing region of the acetabulum there is a large area of reduced density surrounding a sequestered fragment of articular cortex and underlying bone of a density similar to the areas in the head of the femur. A diagnosis of tuberculous arthritis with secondary bilateral invasion and sequestration of the articular bone was made and operation was done. Tuberculous synovitis was proved by microscopic examination and guinea pig inoculation. The articular cartilages were found extensively eroded and loosened from the bone. The femoral head, a photograph of which is shown in Figure 22, contained two almost completely separated sequestra. Its articular cartilage was extensively thinned and loosened from the underlying bone and over the sequestra it had been worn away and exposed the polished articular surface of the necrotic bone. The acetabular articular cartilage was thinned and loosened marginally but was absent over the region of cavitation in the ilium which measured 2 by 2 centimeters. A small sequestrum of articular bone was removed from the cavity. The articular portion of the head of the femur was excised, the walls of the

acetabulum were cutted, and tibial transplants were placed across the joint. Figure 23 is a roentgenogram of the sequestered portions of the femoral head and ilium. The similarity in densities and size of the trabeculae of the kissing sequestra indicates that necrosis occurred simultaneously on the two sides of the joint and is evidence in support of their secondary rather than primary nature.

In 2 cases of advanced tuberculous arthritis in adults small areas of secondary bone invasion in the ilium were observed in roentgenograms made late in the disease. Earlier roentgen examinations showed no bone foci. Pathological examination disclosed cavities in the ilium which contained tuberculous granulation tissue with small fragments of sequestered articular cortex.

SUMMARY AND CONCLUSIONS

Eighty-two cases of tuberculosis of the hip have been studied roentgenologically and 56 pathologically in an attempt to determine the point of primary involvement of the joint structure. The studies were made at varying times in the course of the disease. In general, the earlier they were obtained the greater the frequency with which the primary point of infection was located. In 70 patients the disease began in childhood, while in 12 it began in adult life. In the childhood cases it was possible to determine that the primary point of infection was in the bone bordering on the joint in 26, as follows: neck of the femur adjacent to the head, 14; ilium bordering on the acetabulum, 10; ischium bordering on the acetabulum, 2. It is to be noted especially that in no patient was a primary lesion identified in the head (epiphysis) of the femur. In all of these patients except 2 in whom the disease started in the neck (metaphysis) of the femur it sooner or later broke into the hip joint and resulted in a diffuse tuberculous arthritis.

In the 44 remaining childhood cases it was impossible to determine the primary point of infection, whether in the synovia, the metaphysis, or the epiphysis. In most of the patients the examinations were made after there had been secondary invasion and breaking down of bone on both sides of the joint, which was sufficient to obscure or to destroy completely the primary focus in those in whom it was located in the bone. Care has to be

exercised not to mistake an area of bone secondarily invaded in the acetabulum or especially in the head of the femur for a primary osseous focus

In 9 patients the examination was made early before there was appreciable breaking down of the ends of the bones, and no primary osseous focus was identified which would speak for primary localization in the synovia. However, it is impossible in such cases to rule out with certainty a primary osseous focus which was so small that it escaped detection in the roentgenograms or in the rather incomplete pathological examinations that could be made of the tissue excised at operation

In the 12 patients in whom the disease began in adult life, the lesion was identified as primary in the greater trochanter in 2, with secondary invasion of the joint. In 1, it was primary in the ilium. In the 9 remaining it is impossible to state whether the lesions were primary in the synovia or in the bone because

of the difficulty of recognition of very small primary osseous foci and because of the extensive secondary invasion and destruction of bone that was present in some cases. It is noteworthy that primary localization of tuberculosis at the hip in these patients is similar to that of pyogenic infection of the same region which is known to be rare in the capital epiphysis and common in the femoral metaphysis and ilium

BIBLIOGRAPHY

- 1 KOENIG F. Die specielle Tuberculose der Knochen und Gelenke. Berlin vol. 1 1896, vol. 2 1902
- 2 NUSSBAUM A. Ueber die Gefasse des unteren Femur endes und ihre Beziehungen zur Pathologie. Beitr. z. Klin. Chir. 1923 129 245
- 3 PREMISTER D. B. Pyogenic osteomyelitis. Nelson Loose leaf Living Surgery vol. 7 pp. 603-727
- 4 Idem. Effect of pressure on articular surfaces in pyogenic and tuberculous arthritides and its bearing on treatment. Ann. Surg. 1924 80 481
- 5 PREMISTER, D. B. and HATCHER C. H. Correlation of pathological and roentgenological findings in the diagnosis of tuberculous arthritis. Am. J. Roentgenol. 1933 29 736

BLOOD VOLUME CHANGES DURING SURGICAL PROCEDURES

JOHN G. GIBSON, 2d, M D, and CHARLES D. BRANCH, M D, Boston, Massachusetts

CHANGES in blood volume incident to surgical procedures are a chief concern for the surgeon. Actual blood loss is a generally recognized factor, but it may not be the most important consideration to be thought of in surgical procedures. In addition there must be considered (1) anesthesia, with its effect upon respiration, arterial tension, and capillary and venous tone, (2) trauma to tissue and handling of viscera with response of the autonomic nervous system, (3) changes in ventilation, affecting insensible water loss and hence the fluid reserve, and (4) the efficiency of the organism in its response, immediate or late, to hemorrhage. Postoperatively, influential factors are the changes occurring during recovery from anesthesia and the effects of the relatively high environmental temperatures to which patients usually are subjected for the first few hours following operation. Of interest also are the effectiveness of fluids administered by mouth or parenterally in restoring blood volume and the possibility of dangerously augmenting the volume by excessive administration of fluids.

Gatch and Little, Maddock and Coller, and Pilcher and Sheard have measured actual blood lost at operation, the method employed being the determination of hemoglobin content of washings of drapes, sponges, etc., used at operation. The results of these separate studies agree closely, and little doubt exists as to the accuracy of the findings. Blood losses range from a few cubic centimeters in minor procedures (appendectomy, herniorrhaphy) to 200 to 300 cubic centimeters in major laparotomies (cholecystectomy, hysterectomy), and may reach 700 to 1,250 cubic centimeters in such procedures as radical mastectomies.

It is possible, however, that the change in circulating blood volume, which influences the condition of the patient during and after op-

From the Medical and Surgical Clinics of the Peter Bent Brigham Hospital and the Departments of Surgery and Medicine, Harvard Medical School, Boston.

eration, may be far greater than due to blood loss alone. Aikawa, using the carbon monoxide method of blood volume determination, observed decreases in total volume ranging from 5 to 39 per cent, averaging about 20 per cent, in 42 of 43 dogs subjected to various abdominal operations. Derra (3) employed a combination of the carbon monoxide and dye methods in studying changes in volume in dogs under avertin anesthesia and observed either increases or decreases in total volume, the extremes ranging from decreases of 28 per cent to increases of 45 per cent of pre-operative values. Schneider and Polano, using the carbon monoxide method, noted a diminution in plasma volume coincident with a fall in minute volume early in anesthesia. Derra (4) observed in dogs undergoing laparotomies that the plasma volume tended to fall and cell volume to rise but with decrease in total volume.

Reissinger and Schneider, using the carbon monoxide method, measured blood volume before and after operation in humans and observed increases of 100 to 1,420 cubic centimeters as well as decreases of 690 to 2,851 cubic centimeters. In all cases the blood pressure was lower after operation than before.

In this communication we report the results of studies on 12 patients, selected from the surgical wards of the Peter Bent Brigham Hospital, in whom blood volume changes were determined during the actual surgical procedure and during the recovery period.

METHODS

Plasma, cell, and total blood volume were determined by the dye method described by Gibson and Evans (6). This method measures the plasma volume by determining the dilution in the blood stream of an accurately measured amount of an azo dye, "Evans blue," after intravenous injection. The dilution factor used is obtained by extrapolation of the slope of disappearance of the dye from the

blood stream to time of dye injection. The disappearance slope is constructed from the dye concentrations, as determined with spectrophotometer, of a series of blood serum samples taken over a period of 30 minutes after dye injection. The result obtained represents the plasma volume at time of dye injection. Red cell and total volumes are calculated from plasma volume and hematocrit values.

Studies were made in 9 patients by the "direct" method of repeated volumes, a separate dye injection being made for each determination and successive volumes being corrected for blood withdrawn in sampling for preceding volume determinations. Studies of changes occurring during the induction of anesthesia were made in 8 patients by the short "indirect" method. In this procedure the disappearance slope following the injection of dye for the initial volume is first determined over a period of 40 minutes. Samples are then taken during the administration of the anesthetic, and from the initial plasma volume and the deviation of dye concentration of these samples from the prolongation of the disappearance slope changes in plasma volume are calculated. By this method small changes in plasma volume can be measured accurately.

Changes in volume occurring during operation were followed by the long "indirect" method in 3 patients. In this procedure the initial plasma volume is determined on the afternoon of the day preceding the operation. The disappearance slope is determined the following morning and changes during operation are calculated from the initial plasma volume and the deviation of dye concentration of blood serum samples taken during operation from the prolongation of the disappearance slope. A study of this type is shown in Chart 1. This method permits of making determinations of the plasma volume at any time during operation without another injection of dye.

RESULTS

Anesthesia Four patients were studied during nitrous oxide-oxygen induction and ether anesthesia, 2 during avertin induction and ether anesthesia, 1 during local regional anesthesia with novocain, and 1 during spinal anesthesia with novocain. Pre-operative changes

in blood volume during anesthesia in these patients are summarized in Table I.

In every case the induction of anesthesia was accompanied by a slight but definite decrease in the plasma volume. The diminution in plasma volume is temporally related to elevation of blood pressure and pulse and respiratory rates. In 2 patients, Cases 253 and 270, in whom anesthesia was induced with avertin, no change in blood pressure occurred, and the plasma volume was but slightly reduced. Following the administration of ether, no change in pressure or volume occurred in Case 253, but in Case 270 a sharp rise in pressure took place, accompanied by a definite decrease in plasma volume. In Case 255 a considerable elevation in blood pressure occurred during gas-oxygen and ether induction of anesthesia, accompanied by a striking decrease in plasma volume. In Case 260 basal blood pressure was elevated, gas-oxygen ether induction was accompanied by an initial further rise and subsequent fall in pressure, and plasma volume remained fairly constant. In 1 patient, Case 268, who was operated upon under local novocain anesthesia, infiltration was followed by a sharp rise in pressure, and the plasma volume was diminished.

Variable fluctuations in cell volume occurred. In the 4 patients anesthetized with gas-oxygen and ether it increased in 1 and was slightly reduced in 3. An increase occurred in the 2 cases in which avertin was used, Cases 253 and 270, while in the 2 cases in which novocain was used, Cases 268 and 290, a decrease took place. Thus the cell volume was diminished in 4 and increased in 4 of these patients. Yet in all but 1 case (Case 290) the hematocrit value rose with the induction of anesthesia, indicating a slight hemoconcentration.

As regards total volume, it may be said in general that the degree of reduction therein due chiefly to loss of fluid from the blood stream, parallels the degree of elevation of blood pressure.

Effect of surgical procedure The course of changes in plasma and total volume was followed through the period of operation in 3 patients, and during the immediate postoperative period in 2 of these 3, the changes being

TABLE I—CHANGES IN BLOOD VOLUME DURING INDUCTION OF ANESTHESIA IN RELATION TO BLOOD PRESSURE, PULSE, AND RESPIRATORY RATES

	Nitrous oxide and oxygen with ether											
	Herniorrhaphy			Hysterectomy			Incision and suture			Cholecystectomy		
	No 226	M 7-23-36	38 yrs	No 254	F 12-1-36	30 yrs	No 255	M 12-3-36	30 yrs	No 260	F 12-17-36	49 yrs
Anesthesia level	Basal	Early	Deep	Basal	Light	Deep	Basal	Deep	Deep	Basal	Light	Deep
Plasma volume c cm	3670		3510	2310	2190	2155	2530	2450	2380	2060	2035	2040
Cell volume c cm	2840		3060	1170	1125	1145	2850	2800	2810	1780	1740	1770
Total blood volume c cm	6510		6570	3480	3315	3300	4470	4250	4190	3840	3775	3810
Hematocrit cells, per cent	43.6		46.5	33.5	33.9	34.7	42.3	42.3	43.1	46.0	46.2	46.5
Blood pressure mm Hg	160/60		110/80	130/80	140/87	150/98	110/80	127/83	140/95	100/60	205/105	180/85
Pulse per min	100		75	60	163	158	68	80	103	110	105	90
Respiration per min	20		22	13	28	30	20	24	30	20	22	22
	Rectal avertin and ether						Local infiltration with novocain			Spinal novocain		
	Herniorrhaphy			Resection of colon			Gastric resection			Herniorrhaphy		
	No 253	M 30 yrs		No 270	F 48 yrs		No 268	M 63 yrs		No 290	M 17 yrs	
Anesthesia level	Basal	Early	Deep	Basal	Early	Deep	Basal	Early	Deep	Basal	Early	Deep
Plasma volume c cm	3620	3530	3565	2220	2190	2060	2450		2350	2260		2200
Cell volume c cm	3270	3350	3445	950	970	890	1190		1170	2210		2055
Total blood volume c cm	6890	6880	7010	3160	3160	950	3640		3520	4470		4260
Hematocrit cells per cent	47.5	48.7	49.1	30.0	30.5	30.1	32.6		33.1	49.4		48.2
Blood pressure mm Hg	120/80	120/80	120/80	140/60	140/60	170/70	120/80		150/90	150/70		110/70
Pulse per min	60	78	90	150	155	165	80		120	80		75
Respiration per min	20	20	26	24	24	35	21		20	22		20

as illustrated in Charts 1, 2, and 3. In these cases particular care was taken to prevent loss of blood and no considerable amount of bleeding occurred. The blood plasma withdrawn in sampling, not exceeding 60 cubic centimeters during the operation period, was replaced by intravenous injection of equivalent amounts of normal saline, and results were corrected for the small amount of red cells withdrawn.

In Cases 226 and 224, small fluctuations in plasma volume and total volume occurred, never greater than 100 to 150 cubic centimeters. These changes can be related to changes in blood pressure associated with the opening of the peritoneum and the handling of viscera. An elderly man, Case 268, with advanced carcinoma of the stomach, in whom local novocain was used, underwent a resection of the pyloric end of the stomach and a Billroth I anastomosis. The course of plasma and total blood volume bore an inverse relationship to

changes in blood pressure during the operation. The volume remained below the pre-anesthesia level throughout operation and a repeated volume determination at the end of the operation revealed a net decrease in total volume of 250 cubic centimeters. In our opinion this decrease was not due to blood lost during operation but represents a change in volume due to physiological changes in response to trauma of operative procedures.

As shown in Table II, in 10 of the 12 cases in this series the total volume determined at the end of operation was below pre-operative levels, reductions ranging from 60 to 265 cubic centimeters and averaging 154 cubic centimeters. In the 2 other cases slight increases amounting to about 50 cubic centimeters took place. In 1 case plasma volume was unchanged, in 11 reduced, extremes ranging from 10 to 290 cubic centimeters, averaging 145 cubic centimeters. Red cell volume was re-

TABLE II—POSTOPERATIVE CHANGES IN BLOOD VOLUME

Case number	230	247	254	224	226	232	255	257	260	268	270	290
Age and sex	38 M	48 F	39 M	30 F	38 M	42 M	30 M	30 M	49 F	63 M	48 F	17 M
Operation and date	Tonsillectomy 7-31-36	Uterine repair 11-17-36	Hysterectomy 12-1-36	Hemorrhaphy 7-12-36	Hemorrhaphy 7-22-36	Ligation of pulmonary 8-6-36	Hemorrhaphy 12-3-36	Hemorrhaphy 12-8-36	Cholecystectomy 12-17-36	Pyloric resection 12-31-36	Resection of colon 1-9-37	Hemorrhaphy 2-19-37
Initial volume												
Plasma c cm	3180	2680	2310	2765	3670	2845	2530	3620	2660	2450	2210	2260
Cell c cm	2870	1540	110	2660	2840	2105	1850	3270	1780	1190	9	2210
Total blood c cm	6050	3620	3450	5325	6510	5250	4470	6890	3840	3640	3160	4470
Hematocrit cells per cent	47.3	42.5	33.5	48.0	43.6	45.8	42.3	47.5	46.0	32.6	30.0	49.4
Postoperative volumes												
Hours minutes postoperative	2 0	0 10	0 10	0 30	0 36	0 30	0 20	0 20	0 30	1 05	0 20	0 20
Plasma c cm	3040	1900	2160	2680	3380	2730	2510	3480	1955	2240	1975	2 60
Cells c cm	2810	1455	113	2605	3170	2470	1940	3380	1785	1180	1015	1105
Total blood c cm	5850	3355	329	5285	6 50	5130	4450	6760	3740	3420	3000	4270
Hematocrit cells per cent	47.6	43.2	33.9	48.8	48.3	46.4	43.1	48.3	47.2	33.8	31.5	48.1
Change in total volume c cm	-200	-26	-18	-60	-140	-120	-140	-130	-100	-220	-160	-20
Weight loss kilograms	0 0		0 8	0 4		0 8	0 8	0 3	1 0	0 5	1 5	
Hours minutes postoperative		2 10			2 21						3 43	2 30
Plasma c cm		2015			3150						2110	2180
Cells c cm		1545			2875						740	1940
Total blood c cm		3580			6025						2850	4120
Hematocrit cells per cent		43.0			47.7						25.3	46.1
Change in total volume c cm		40			485						-310	-150
Weight loss		0 8			1 8						+0 2	+0 4
Remarks												
	See Note 1	See Note 2	See Note 3	See Note 4	See Note 5	See Note 4	See Note 4	See Note 4	See Note 4	See Note 6	See Note	See Note 8

¹Moderate bleeding²Persistent oozing³2 degrees anemia; hemostasis good⁴Little bleeding⁵Little bleeding. Profuse perspiration in ether bed⁶2 degrees anemia. Little bleeding⁷2 degrees anemia. 175 c cm. normal saline intravenously between 2d and 3d volume⁸950 c cm. saline intravenously between 2d and 3d volume.

duced in 6 patients, the extremes ranging from 10 to 85 cubic centimeters, averaging 43 cubic centimeters, and increased in 6 patients, the extremes ranging from 5 to 330 cubic centimeters averaging 112 cubic centimeters. In general, weight loss bore a direct relation to the degree of reduction in total volume.

Thus it is apparent that total volume is diminished at the end of operation, but that an active response of the organism to blood loss, in the form of an influx of red cells into the circulation, takes place during operation.

The recovery period. That the reduction in the level of the blood volume during the immediate postoperative hours is not due to blood loss at operation alone is evident from

data presented in Chart 1. This patient, Case 226, experienced a greater reduction in total blood volume during recovery, amounting at its height to about 500 cubic centimeters, than at any time during operation. This change took place after the patient had been placed in the routine "ether" bed, during which period no fluids were given, perspiration was observed to be moderately profuse, and room temperature was relatively high (83 degrees F). In Case 224 the total volume was slightly increased at the end of operation, due to an increase in cell volume large enough more than to offset the diminution in plasma volume. However, observations made after 2 hours in the "ether" bed indicate a continued loss of

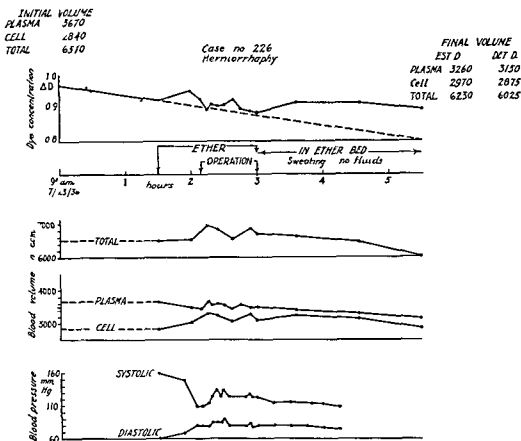


Chart 1 Changes in plasma, cell and total volume in a patient (Case 226) undergoing herniorrhaphy under ether anesthesia. The method of determining plasma volume at various times during operation from dye concentration value of the prolongation of the disappearance slope and of the blood serum samples is shown. The final re determined volume checks closely with the final estimated volume. Slight changes in volume occurred during anesthesia and operation. The red cell volume increased. During recovery in an "ether" bed a marked diminution in plasma volume took place, reduction in total volume exceeded blood lost at operation.

plasma and a reduction in circulating cell volume to pre operative level.

Restoration of depleted blood volume. Two cases in Table II are of particular interest in this respect. One patient, Case 247, in whom there was obvious bleeding, had a reduction in total volume of 265 cubic centimeters at end of operation, or 7.3 per cent of pre-operative volume, yet several hours later, although no fluids were given, plasma and cell volume were almost completely restored. This patient did not perspire freely in "ether" bed.

In contrast, another patient, Case 225, experienced a reduction in total volume of 525 cubic centimeters in a little over 2 hours after the end of operation, during which period no fluids were given. This patient was operated upon on a warm day and was observed to sweat profusely in the "ether" bed.

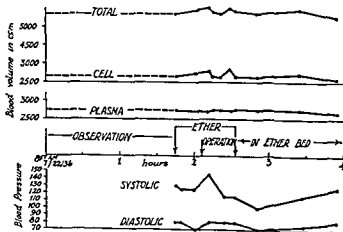


Chart 2 Blood volume changes in a male patient aged 30 (Case 224) undergoing bilateral herniorrhaphy under ether anesthesia. Very little change in plasma volume occurred during anesthesia or operation, but there was a marked increase in red cells resulting in an increase in total volume. During recovery no marked diaphoresis was noted in this patient and there was no considerable loss of plasma.

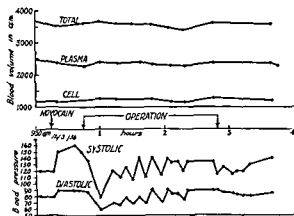


Chart 3 Blood volume changes in a male patient aged 63 (Case 268) with carcinoma of the stomach and secondary anemia undergoing gastric resection and a Billroth I anastomosis under local infiltration with novocain. A definite diminution in plasma volume accompanied the elevation in blood pressure following novocain injection followed by an increase coincident with a drop in blood pressure when the abdominal cavity was opened. The influx of red cells was not marked in this anemic patient although the level was well sustained.

To 2 patients, Cases 270 and 290, were given postoperatively 1000 cubic centimeters of normal saline intravenously. Both of these patients showed moderate reductions in total volume at the end of operation. In both cases volume determinations made after the completion of fluid administration showed a slight increase in plasma volume over the immediate postoperative level, but a definite decrease in total volume was shown even from the preoperative level, due to marked diminution in circulating cell volume. Both patients showed slight gain in weight over pre operative values.

In this study we have not encountered the extreme reductions or increases in blood volume after operation, as observed in dogs by Aikawa and Derra (3) or in humans by Reisinger and Schneider and Schneider and Polano. In practically every instance in our series the plasma volume as determined postoperatively was lower than the pre-operative level. We conclude that the variable findings of the above authors arise from errors in the techniques employed, as previously described (6).

EVALUATION OF OBSERVATIONS

It is apparent that the changes in blood volume during the induction of anesthesia bear a

direct relationship to the rise in blood pressure experienced. This finding is in keeping with observations made by us on the prompt and considerable decrease in volume that accompanies sudden elevation of systemic pressure, due to exercise or the intravenous injection of insulin or adrenalin. It is suggested that this lowering of plasma volume is due to a disturbance of the normal filtration absorption balance of the capillaries brought about by an increased pressure gradient from the afferent to the efferent end of the capillaries, more fluid being forced out into tissue spaces at the proximal end than can be re absorbed at the distal end. That this mechanism operates in a reversible manner is suggested by increases in plasma volume seen in course of operation during marked decreases in systolic pressure.

An additional factor in the decrease in plasma volume lies in the hyperventilation accompanying anesthesia with increased removal of water from the blood via the pulmonary aeration bed. This factor of increased insensible water loss probably continues throughout the period of anesthesia. Under nembutal anesthesia in normal dogs the plasma volume steadily decreases with prolongation of narcosis.¹

Of interest is the apparent rapidity with which a falling volume may be augmented by an increase in the volume of circulating red cells. This phenomenon not only has the effect of aiding mechanical circulatory efficiency through volume restoration but also of increasing the oxygen carrying capacity of the blood in the face of a threatened anoxemia.

None of the cases studied during operation were in the condition known as "surgical shock," systolic pressure having been well maintained throughout. In Case 268 (Chart 3) a sharp fall in systolic pressure was accompanied by an increase in plasma and cell volume from levels obtaining during a previous period of higher blood pressure. The concurrent state of falling arterial tension and lowered blood volume was not consistently encountered in this study. This observation suggests that low tension "shock" need not necessarily be accompanied by a reduced total blood volume, at least in the initial stages.

There can be little doubt that the placing of patients in relatively high environmental temperatures during recovery, however advisable from other points of view, has the effect of lowering blood volume. This observation is in keeping with the findings of Gibson, Kopp and Evans (8) in the course of studies on blood volume changes during artificial fever, in which rapid and marked reductions in plasma volume occur during sweating. Since the output of the sweat glands is drawn directly from the blood stream, diaphoresis may deplete the circulating volume more rapidly than tissue fluid reserves can restore it. We regard these observations as serving to place further emphasis on the necessity of fluid administration during the period of immediate postoperative recovery.

The effect of postoperative intravenous administration of fluids was studied in only 2 cases in this series, and in both an apparently paradoxical response, namely, a decrease in total volume, was encountered, the decrease being accounted for by a withdrawal of red cells from circulation. We have observed that a similar decrease in red cell volume follows the rapid (30 cubic centimeters per minute) intravenous infusion of normal saline solution.

Similar observations have been made recently by Gilligan and Altschule following intravenous injections of isotonic or hypertonic salt solutions. Coller, Dick, and Maddock noted retention of water to the point of development of edema in patients receiving salt solutions intravenously. Our observations in these 2 cases offer an explanation of the formation of such edema. It should be emphasized, however, that both of these patients had sound hearts. It is possible that in patients with cardiac insufficiency, in whom the blood volume is already increased (7), administration of fluids intravenously might dangerously increase the total volume. It is suggested that hypertonic dextrose solutions are of greater usefulness in restoring depleted volumes than are normal saline solutions.

CONCLUSIONS

- 1 The plasma and total blood volume changes during anesthesia, operation, and recovery therefrom are described.
- 2 During anesthesia the decrease in plasma volume bears a direct relationship to the degree of elevation of blood pressure.
- 3 During operation fluctuations in the blood volume level vary with fluctuations in arterial tension, a rise in systolic pressure being accompanied by a fall in plasma volume, and vice versa.
- 4 The total volume is reduced at the end of operation, the reduction being due to a diminution of plasma volume, larger than can be offset by influx of red cells into the circulation.

BIBLIOGRAPHY

- 1 MIKAWA, T. Experimentelle Untersuchungen ueber zirkulierende Blutmenge und Operationstrauma. *Arch f klin Chir*, 1934, 181: 330-336.
- 2 COLLER, F. A., DICK, V. S., and MADDOCK, W. G. Maintenance of normal water exchange with intravenous fluids. *J Am M Ass*, 1936, 107: 1522-1527.
- 3 DERRA, E. Das Operationstrauma in seiner Einwirkung auf Lungenatmung, capillaren Gasaustausch und zirkulierende Blutmenge, III. Mitteilung Blutmenge und Narkose. *Deutsche Ztschr f Chir*, 1936, 247: 82-95.
- 4 Ibid pp 187-207.
- 5 GATCH, W. D., and LITTLE, W. D. Amount of blood lost during some of the more common operations. *J Am M Ass*, 1924, 83: 1075-1076.
- 6 GIBSON, J. G., 2d, and EVANS, W. A., JR. Clinical studies of the blood volume, etc. *J Clin Invest*, 1937, 16: 301-316.
- 7 Idem. Clinical studies of the blood volume. III. Blood volume changes in chronic congestive heart failure. *J Clin Invest* (in press).
- 8 GIBSON, J. G., 2d, KOPP, I., and EVANS, W. A., JR. Blood volume changes during therapeutic fever. Abstracts and discussions, First Internat Confer Fever Therap, 1937. In process of publication.
- 9 GILLIGAN, D. R., ALTSCHULE, M., and VOLK, M. C. The effect on the cardiovascular system of fluids administered intravenously in man. I. Studies of the amount and duration of blood volume changes. *J Clin Invest* (in press).
- 10 MADDOCK, W. G. and COLLER, F. A. Water balance in surgery. *J Am M Ass*, 1937, 108: 1-6.
- 11 PITCHER, I. JR., and SHEARD, C. Measurements on loss of blood during transurethral prostatic resection, etc. *Proc Staff Meet Mayo Clin*, 1937, 12: 209-213.
- 12 REISSINGER, H., and SCHNEIDER, H. Zirkulierende Blutmenge und Operationstrauma. *Deutsche Ztschr f Chir*, 1929, 217: 303-320.
- 13 SCHNEIDER, H. (FREIBURG), and POLANO, H. Untersuchungen ueber das Verhalten der zirkulierenden Blutmenge. *Klin Wchnschr*, 1933, 12: 1086-1091.

HEPATIC LESIONS OF THE NEWBORN

AARON SUMNER PRICE, M.D., New York, New York

LIVER damage in the newborn has seemed to occur more frequently in recent years, probably because of closer observation. While the present series of 69 cases is small, and taken entirely from the records of the New York Polyclinic Medical School and Hospital—covering a period of approximately 6 years—personal observation of similar lesions has been made in other hospitals. No particular significance was attached to the observations at the time. One lesion of the liver, characterized by fatty degeneration and early necrosis, has seemed to be of toxic type. It has occurred with sufficient frequency to justify a review of the clinical history to see what factors might have a bearing on its etiology.

The type of lesion found postmortem in the newborn, which has been most difficult to explain, has consisted of a distention of the hepatic cells with a fine deposit of lipid giving the cells a vacuolated and emulsified appearance. In addition, many of the cells have shown early necrosis and the sinusoids have appeared almost obliterated. The lesion has seemed to commence most commonly in the central zone, although it may be distributed in patches throughout the lobule. As the lesion has progressed, the entire lobule has appeared affected, and the liver has been enlarged and has had a tense capsule. In the absence of marked congestion, the gross specimen has been of a definite yellow, or brownish yellow color. On section, the cut surface has at times been uniform and at other times mottled, depending upon whether the lesion was uniform, central, or patchy. This lesion is definitely different from the diffuse distribution of large fat droplets sometimes found in the livers of newborn laboratory animals.

It is believed that it is possible to recognize pathologically, with a reasonable degree of accuracy, those lesions resulting from pre-

maturity, passive congestion, postmortem degeneration, simple fatty infiltration, syphilis, and antenatal arsenamine poisoning. None account for the lesion described.

The premature liver The premature liver is better developed, in so far as histological appearance is concerned, at an earlier date than many of the other organs. There is little difference between the premature liver and that of the full term newborn except that the blood islands are more numerous and larger, the liver cords thinner, the cells smaller, and the sinusoids correspondingly larger. The changes by which the liver lobules are subdivided into the permanent ones do not take place until after birth. The premature liver, after fifth month, is just as satisfactory for study as that of more mature newborn baby.

Passive congestion Passive congestion in the newborn seldom resembles the picture described as chronic passive congestion for adults, unless the baby has lived for a considerable period and has also suffered from a definite cardiac lesion. The central lobular changes which are so characteristic of chronic passive congestion in adults are more the result of some secondary circulatory poison—probably absorbed from the gastrointestinal tract—than from passive congestion *per se*. Anatomical factors in circulation practically prevent the development of such a lesion in the newborn. The passive congestive lesion in the newborn is usually nothing more than an engorgement of the sinusoids, sometimes a rupture of the central liver cords, and a moderate degree of cloudy swelling. Four cases of congenital cardiac defect with passive congestion are included in this series of cases. Any defect in the heart that would severely influence fetal circulation would be apt to lead to maceration and death *in utero*.

Postmortem degeneration If the necropsy is performed within a reasonable time after death the gross changes will be slight. The histological changes will consist chiefly of

cloudy swelling, followed by fragmentation and fraying of the cells. The cytoplasm may appear granular or amorphous. Nuclear changes follow with pycnosis, caryorrhexis, and caryolysis as autolysis is approached. Then the liver is totally unsuitable for satisfactory study. Fatty changes do not constitute a part of postmortem degeneration. *Hyperpyrexia* may hasten postmortem degenerative changes, as well as produce the earlier changes which are indistinguishable from postmortem degeneration. Congestion is usually pronounced in hyperpyrexia.

Simple fatty infiltration Simple fatty infiltration is found to a mild degree in the very well nourished newborn, and to a more marked degree if there has been starvation due to any cause, either prenatal or postnatal. As a rule, the fat globules—usually single, and large—are scattered fairly well throughout the various lobular areas with no close relationship to the central zone. In those recently born suffering from intestinal obstruction, including blind pouch defects, congenital pyloric stenosis, peritonitis, meningitis, extreme hydrocephalus, or certain types of drug poisoning, the fatty infiltration may be marked. Simple fatty infiltration, alone, is unaccompanied by degenerative changes in the cells even when the droplet accumulation pushes the nucleus to one side.

Syphilis Syphilis may occur as a pericellular cirrhosis as a perilobular hepatitis with monocytic and lymphocytic infiltration in the portal canal areas, or as a patchy gummatous necrosis. The lesion is sufficiently inflammatory in appearance, even when necrosis is extensive, to suggest its cause. There is an associated osteochondritis of the long bones, and the small fibrous or better known large boggy placenta may suggest syphilis. Three cases in this series had evidence of syphilis.

Arsenical treatment Prenatal arsenical treatment may occasionally induce toxic necrosis in the fetus, but such a condition should be readily recognized through both the history and the extensive necrotic lesion produced in the liver. It is a much more severe lesion than that described. Should such poisons as phosphorus, arsenic, mercury, or certain salts of most any of the heavy metals

be taken by the mother, or such drugs as cinchophen, dinitrophenol, atophan, and others be taken by susceptible individuals, toxic necrosis might develop in the liver of either, or both, mother and child. This group of possible factors played no part, in the series of cases presented, in the production of hepatic damage.

Acute asphyxia In simple acute asphyxia there is marked engorgement with great distention of the sinusoids, sometimes producing a rupture of the liver cords. Superimposed may be hemosiderosis, and accentuated postmortem degenerative changes. Acute asphyxia should be found in other organs as well. Pulmonary hemorrhage into the alveoli, extreme congestion of all viscera, subpleural and subepicardial petechiae are common.

Partial asphyxia Long continued partial asphyxia as the result of excessive maternal antepartum hemorrhage, continued partial strangulation, intracranial damage, excessive maternal exhaustion, massive placental infarction, and postnatal asphyxia should be recognized through the history and the postmortem examination.

Only one case is known to have had as a contributing factor excessive maternal antepartum hemorrhage. That patient was admitted with a maternal blood pressure of 50/30, and a diagnosis of placenta prævia. A stillborn baby was delivered by cesarean section, and its liver showed marked degeneration like that described. Another case is recorded in which the cord was around the neck of the child at the time of delivery. The total time of the second stage of labor, for that case, was 39½ hours, the baby was covered with meconium, and the liver damage was graded as severe. A third case showed maternal uterine inertia. Small doses of pituitrin were given and the baby, also with marked hepatic degeneration, was delivered 3½ hours later.

Intracranial damage is not believed to have played a large role in the causation of a secondary lesion in the liver, although it probably played a role in a few cases. The reason for the general denial of intracranial damage as a factor is because of the time element. Most, if not all, of the intracranial lesions occurred during the second stage of

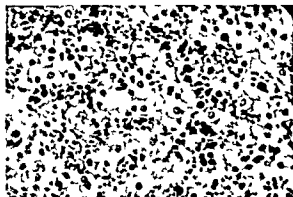


Fig 1 Fatty degeneration and early necrosis in premature liver Blood islands numerous Congestion moderate

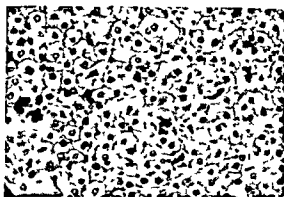


Fig 2 A mature newborn liver showing rather uniform fatty degeneration and early necrosis

labor Most of the labor periods were short and in those dying immediately there would have been insufficient time between the moment the injury was sustained and the moment that death occurred for the lesion to have developed Nevertheless it is true that the greatest degree of liver damage was found with the highest frequency in the still born and these same stillborn did show the highest incidence of intracranial damage None of the stillbirths in this series show any record of having been anticipated clinically Macerated fetuses have been excluded because of their unsuitability for study

The factor of maternal exhaustion is a little more difficult to dispose of without some thought A rough estimate of the degree of comparative exhaustion can be obtained from the average duration of labor (see Table I sections 13 14 and 15) Only 2 cases in

which patients showed marked hepatic degeneration, are recorded as showing any appreciable degree of maternal exhaustion (Table I, section 12) In 7 cases, distributed through the various gradings patients received small doses of pituitrin or thyrophysin, in 3 of these primary uterine inertia was given as the indication for the administration

Since the placentas are not sent to the laboratory for routine examination it is impossible to state what percentage presented massive placental infarction Insufficient data are available to be worth while Judging from the lack of notation, it is believed that massive placental infarction did not play a prominent role

After a study of all of the factors discussed, in only a few cases was a satisfactory explanation offered as to the etiology of hepatic degeneration in the newborn Then, what other factors should be considered? Walters and Harris have suggested that opium derivatives magnesium sulphate barbituric acid derivatives and avertin, reduce the minute volume respiration with a resulting tendency toward asphyxia Davis has placed animals under bell jars until anoxemia and asphyxia have occurred In the livers of these animals he found marked fatty changes had taken place He also found similar results following the use of certain types of anesthesia Therefore it seemed advisable to investigate the clinical history to determine something about the anesthesia used and the preliminary medication given The search proved interesting

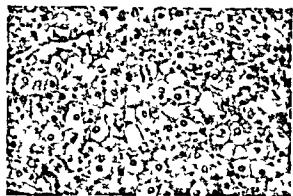


Fig 3 Liver of mature full term baby showing patchy fatty degeneration with early necrosis

In the cases presented the average amount of anesthetic administered was not great, and, except where rectal analgesia was used, the duration of the anesthesia was short (see Table I, section 11) It is perhaps advisable to say at this time that the lesions were graded prior to investigating the clinical history. It may be assumed, from the high percentage of difficult second stage procedures carried out, that the anesthesia was fairly deep. The fact that ether, gas-oxygen, and gas oxygen ether anesthetics were used would seem to make little difference, since any of them under suitable conditions might produce lesions similar to those described. Evidence of hepatic damage does not usually result immediately from anesthesia, but after a delayed period. Time is an element required for the development of a fatty degenerative lesion. Patients who die on the operating room table as the result of excessive anesthesia show little or nothing in their livers. At the end of a number of hours, if damage has been done, it may then be seen. Therefore, it seems that in view of the large percentage of these babies that died so soon after birth, the anesthetic proper administered by inhalation played little part in the production of the liver lesions. It also seems that the preliminary hypnotic medication, and rectal analgesia, played a more important rôle because of the longer period of action during the baby's life.

Rectal ether analgesia is probably capable of producing considerable liver damage, in certain instances. The mixture is absorbed and utilized for anesthesia over a variable but prolonged period of time. The ether must pass through the portal system of the mother, after absorption, to be eliminated chiefly through the respiratory tract. There is the added possibility that quinine may exert its properties in a mild manner as a protoplasmic poison. The average period elapsing between the administration of the rectal analgesia and delivery of the child was 7 hours, with one exception not here included—that was 75 hours.

Each of the derivatives of barbituric acid may have its clinical advantages as claimed

(2) However, with reliable products it is believed that the effective dose is not as important, in the production of hepatic lesions,

TABLE I—SUMMARY OF CASES

Cases are grouped according to the severity of the hepatic lesion found, into 1, 2, 3, and 4+.

Section		Severity of hepatic lesion					
		None	1+	2+	3+	4+	Totals
1	Mothers—primipara	10	4	7	4	12	43
	Mothers—multipara	10	3	2	5	6	26
2	Average age primipara	25	26	9	31	27	
	Average age multipara	30	31	20	32	30	
3	Males autopsied	13	2	5	1	8	31
	Females autopsied	13	5	4	0	10	38
4	Premature babies	14	2	4	2	0	28
	Full term babies	12	5	5	7	1	41
	Spontaneous delivery	13	0	3	2	2	20
	Breech extractions	5	3	1	3	0	20
	Forceps used	7	4	3	2	7	23
	Cesarean section	1	0	0	2	3	6
6	Congenital cardiac lesions	2	0	1	0	1	4
7	Evidence of syphilis	2	0	0	1	0	3
8	Intracranial damage (hemorrhage, tentorial laceration, fracture skull or neck)	10	5	4	3	12	34
9	Stillborn or lived less than 30 minutes	4	3	5	2	12	26
	Lived less than 12 hrs	11	1	0	2	4	18
	Lived less than 24 hrs	2	0	2	0	0	4
	Lived from 2 to 13 days	0	3	2	5	2	21
10	Maternal toxemia	1	0	2	1	1	5
11	Hypertension only sign No toxemia	1	0	3	1	2	7
	Average duration of anesthesia up to none 31 of delivery in minutes	17	27*	20	29	28	
12	Exhaustion recorded	0	0	0	0	2	2
	Received pituitrin or thyrohypophysin but not recorded as showing exhaustion	3	1	1	0	2	7
13	Average duration of labor in hours	0	21	21	21	19	
14	Cases with more than 12 hrs of total labor	0	1	6	3	0	31
	Cases with less than 12 hrs labor	17	3	3	6	9	38
15	Longest periods of labor for individual cases over 12 hrs	72 40 34 24 22 17 14 12 12	72 28 23 17 15 14 13 12	55 48 23 17 15 14 13 12	84 80 39 34 29 26 20 19 12	80 53 39 34 29 26 20 19 12	
	Rectal analgesia	0	1	4	0	6	11
16	Barbiturates given	4	5	3	5	9	36
	Received neither	22	1	2	4	3	32
Totals		26	7	7	0	18	60

*One case of 3 1/2 hrs anesthesia not included

†One case showed maternal exhaustion one case admitted as a placenta previa with blood pressure of 50/30 delivered by cesarean section and stillborn one case had pituitrin administered for failing uterine inertia delivered 3 1/2 hrs later

as the time that elapses between the administration of the drug and the birth of the child, plus individual susceptibility. "All barbitals act alike qualitatively, differing only quantitatively, so nothing is to be hoped for in the way of better and safer therapeutics from a barbitol alleged to be effective in small dosage. The efficiency varies directly with the toxicity. The excretion of the barbitals is comparatively slow, and the drugs show a tendency to accumulate without complete destruction. The drugs are also recognized as having some undesirable properties as general protoplasmic poisons" (3). In obstetrics, after the administration of barbiturates it has been observed that the babies have a greater tendency to be apneic and require respiratory stimulation with comparative frequency. The action of the derivatives of barbituric acid is continued at least for a short time, in the child after its birth.

In the series presented, the preliminary medication was often administered prior to the onset of true labor. The average dose of sodium amytal was 6 grains, nembutal $4\frac{1}{2}$, and 9 grains in 1 instance, and luminal dosage varied from $1\frac{1}{2}$ grains to a total dosage of $28\frac{1}{2}$ grains in one instance. The average period of time elapsing between the administration of the drugs to the mother and the delivery of the child was as follows: sodium amytal 17 hours, nembutal 32 hours, luminal 26 hours, with 3 exceptions not included which averaged 134 hours.

From the preceding discussion it may be seen readily that no positive conclusions can be drawn from this series of cases nor any similar series of cases based on clinical and pathological evidence, primarily because of the multiplicity of factors involved.

Sixty-nine newborn infants were subjected to necropsy and showed livers suitable for study. Nearly every case except 2, presented a definite cause for death which was sufficient to exclude liver damage as the chief cause. Many of the babies were prematurely born (see Table I, section 4). A large number were born by difficult breech extractions with the

aid of forceps (see Table I, section 5). A high percentage presented evidence of intracranial damage such as hemorrhage, tentorial laceration, or other evidence of injury in the region of the head (Table I, section 8). Eight of these showed definite fractures of the skull, 2 occipital parietal osteodiasis, and 3 a fractured neck.

By reviewing section 16 of Table I it may be observed that of the 26 cases showing no evidence of hepatic damage only 4 received preliminary hypnotics. Of the correspondingly opposite group, showing marked hepatic damage, there were 18 cases. Fifteen of these had preliminary medication of some sort. It will also be noted that for this latter group the average length of life after birth was the shortest of any group (Table I, section 9). Twelve of the 18 babies lived less than 30 minutes. Actually, 10 were stillborn. The longest anesthetic given to any in this group was 45 minutes with an average of $28\frac{1}{2}$ minutes (Table I, section 11).

The purpose of this article has not been to suggest that the use of barbitals is entirely undesirable. It is not believed that the hepatic lesions described could have done more than add to the embarrassment, and certainly many cases must recover without evidence of hepatic damage when there is no other primary factor to produce death. The only suggestion that can be drawn with reasonable safety is the derivatives of barbituric acid and rectal ether analgesia when administered to the mother are not completely without toxic action on the fetus. If these drugs are used judiciously, they ought to give satisfaction. Should their toxic action be disregarded they will be found to exert an embarrassing detrimental effect on too many occasions.

REFERENCES

1. DAVIS C. H. Gynecology and Obstetrics. Anesthesia and Analgesia in Obstetrics. 3. Chapter 16.
2. TRITSCH J. E. and BROWN R. Barbiturates in primiparous labors. *Am J Obst & Gynec* 1933; 29: 600.
3. Council on Pharmacy and Chemistry. Intravenous use of barbitol compounds. *J Am M Ass* 1931; 97: 1886.

ACUTE OSTEOMYELITIS OF THE UPPER END OF THE FEMUR

RANDOLPH JONES, Jr, M D, and LOUIS ROBERTS, M D, Durham, North Carolina

CHANGES in bone similar to those caused by osteomyelitis have been found in the remains of prehistoric animals. The head and neck of the femur of a giant wolf found in a pleistocene deposit in California showed changes resembling those which result from a "septic hip" infection as seen in a child today (28). Evidence of osteomyelitis has been seen in prehistoric human bones unearthed in caves and burial grounds of Europe, Asia, Northern Africa (6), and North America (20). Egyptian mummies have shown destruction of the mandible resulting presumably from infection (38). The Hippocratic school recognized the bone infection which followed compound fractures and endeavored to prevent and to treat it.

Throughout the dark ages little was added to the knowledge of osteomyelitis until the fourteenth century when John Ardenne advocated the removal of sequestra, and Scultetus, in 1634, is said to have been the first to resect the shaft of a long bone for infection (47). In 1705, J. L. Petit described an acute disease of the long bones which we now recognize as acute osteomyelitis, and Nelaton, in 1834, suggested that the term osteomyelitis be used to designate infection of bone (40). Pasteur, in 1878, isolated the *Staphylococcus aureus* which he considered the cause of a "furuncle of bone," and, in 1884, the same organism was shown by Becker to be the usual causative agent of acute bone infection.

It remained for Lexer, in 1896, to elucidate the pathology of acute hematogenous osteomyelitis by producing the disease in rabbits. Meanwhile, Senn, in 1895, had observed clinically the primary focus in the metaphysis and was among the first to advocate early drainage of this area as the treatment of choice in acute osteomyelitis. During the twentieth

century advances have been made in the treatment of the systemic infection, and there has been a more widespread acceptance of the principles of drainage of the infected bone as advocated by Senn, Lexer, and Starr.

ANATOMICAL CONSIDERATIONS

A knowledge of the anatomy of the upper part of the femur and the hip is necessary to an understanding of the course followed by infections in this region. The changes in the location of the epiphyseal lines of the upper femur throughout infancy and adolescence are shown by the roentgenographic tracings in Figure 1. The epiphyseal line of the head of the femur is partially intracapsular at birth and becomes entirely intracapsular when the child is 2 or 3 years old. Throughout the period of growth the epiphyseal line of the greater trochanter is in close juxtaposition to the capsule of the hip joint on the upper anterior aspect of the femoral neck (10), while the epiphysis of the lesser trochanter is at some distance from the hip joint. Because of the proximity of the joint, infections of the femoral neck arising in the metaphysis opposite the capital epiphysis or the epiphysis of the greater trochanter frequently give rise to a pyarthrosis of the hip.

The blood supply of the upper end of the femur (Fig. 2) throughout the period of bone growth is derived in large part from the superior branch of the nutrient artery, as was well shown by Lexer and his associates. These observers also described the vessels which penetrate the periosteum and enter the cancellous bone of the upper end of the femur, as well as the branches of the medial and lateral femoral circumflex arteries which pass through the capsule of the hip joint and course along the neck beneath the synovial reflection to join the vascular bed at the capital epiphyseal line. The vessels in the round ligament, which have long been recognized, have recently been

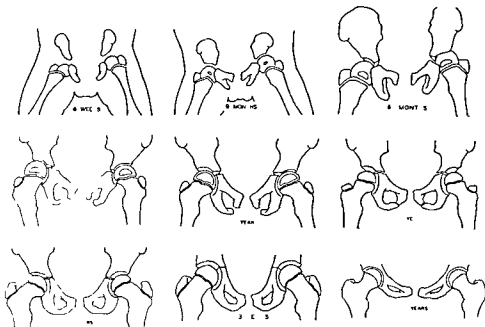


Fig. 1. Tracings of roentgenograms showing the epiphyseal lines of the upper end of the femur. The capital epiphysis lies within the capsule of the hip joint after 2 years of age and the epiphyseal line of the greater trochanter is in close juxtaposition to the capsule of the hip joint.

restudied and are considered by some observers (17, 50) to be of major importance in the nutrition of the capital epiphysis during the period of growth, while others (42, 46) attribute some of this function to arteries which penetrate to the head from the epiphyseal line.

The transition in the vascular tree from the relatively narrow caliber of the nutrient artery to the wide circulatory bed of the capillaries is attended by a slowing of the blood stream at the epiphyseal line. As the capillary buds grow upward into the epiphysis they form diverticulous vascular pouches in which the capillary circulation is even more markedly slowed (31). Thus, any trauma sufficient to damage the capillary wall in this region may well lead to the stagnation of the local circulation, the lessening of the local resistance, and the creation of a favorable site for the development of infection from organisms in the blood stream.

The lymph drainage from the upper end of the femur ascends through the deep lymphatic trunks to reach the iliac lymph glands (17). From the hip joint the lymph drains by

way of the deep system into the deep femoral and iliac lymph glands (18). It should be noted that there are no direct trunks from the upper femur or hip to the inguinal lymph glands and that the latter do not become enlarged or tender in cases of infection of the upper femur, or hip joint, until late in the course of the disease, if they are affected at all.

PATHOLOGICAL CONSIDERATIONS

The present conception of the early bone changes in acute hematogenous osteomyelitis is in large measure derived from experimental reproduction of the disease in rabbits. Rosenbach was among the first to produce experimental hematogenous infection of bone by injecting organisms into the blood stream and fracturing the tibia, however, it remained for Lexer to produce in rabbits a disease comparable in virtually every respect to the acute hematogenous osteomyelitis of man. By injecting *Staphylococcus pyogenes aureus* into the veins of young rabbits, he obtained early foci in the metaphysis adjacent to the epiphyseal line. He also demonstrated the spread of infection along the epiphyseal line to give

ase to subperiosteal abscesses, and where the epiphyseal line was largely intracapsular as at the hip, showed direct extension of pus into the joint cavity as a result of rupture through the synovia from the lesion at the epiphyseal line¹ (Fig 3). The marrow cavity was thought to be involved by progression of the infection through the cancellous bone of the metaphysis, recently, however, this extension is believed to occur more often from the subperiosteal region *via* the haversian canals (45). Late in the acute stage of the disease soft tissue abscesses from the spontaneous rupture of a subperiosteal abscess or of a pyarthrosis of the hip may occur. The series of pathological changes observed in the experimental animal has been seen repeatedly in the acute hematogenous osteomyelitis of man.

The microscopic picture of the early focus is that of a minute abscess in which the organisms can often be seen. While the inflammatory reaction is confined to the metaphyseal side of the epiphyseal line, organisms have been found extending up into the adjacent epiphysis (36), and at times the infection penetrates directly through the epiphyseal cartilage into the joint. As the lesion spreads, thrombosis may contribute to the bone necrosis caused primarily by the infection (47). Although it is beyond the scope of this paper to consider chronic osteomyelitis, the frequency of separation of the capital epiphysis of the femur late in the course of acute infections of the femoral neck should be noted. In long standing infections of the hip joint with attendant relaxation and destruction of the capsule, there is also a tendency for the head of the femur to become dislocated. Unless preventive steps are taken, secondary infection of the hip often results in destruction of the epiphyseal cartilage (33) and eventual ankylosis of the hip. Following damage to the capital epiphysis there is often a disturbance of the growth of the femur which results usually in shortening of the leg although at times lengthening may occur.

¹In our experimental laboratory a virulent culture of hemolytic *Staphylococcus aureus* was injected into the nutrient artery of the femur in 10 immature rabbits. Seventeen of these animals developed either gross or microscopic bone lesions. The most frequent site was the lower end of the femur, though in 1 the upper end of the femur was involved. In one of these a pyarthrosis of the hip also occurred. Eight cases of pyarthrosis of the knee were found and in several of these the spread into the joint from abscesses along the epiphyseal line could be demonstrated.

The systemic effect of the disease and the complications which not infrequently develop from the co-existent blood stream infection are of equal importance to the bone focus. Although the toxemia which forms so prominent a part of the clinical picture is due to the presence of the infection (8, 16), the patient's resistance may be lowered by the development of dehydration and acidosis. Metastatic abscesses may occur in any organ but are most frequent in other bones, in the kidneys, and in the lungs.²

CLINICAL CONSIDERATIONS³

Between 1930 and 1936, 21 patients with acute hematogenous osteomyelitis of the upper end of the femur were admitted to the wards of the Duke Hospital. In this survey the children with mild or low grade infections, and those with acute transient symptoms, have not been included. With few exceptions a complete follow-up study has been made of each patient at intervals of every 12 months or less and efforts have been directed toward obtaining an accurate clinical and x-ray record of the disease in the individual case. These patients have been of particular interest because they present a difficult problem in diagnosis and in treatment. The observations which follow are recorded not in the conviction that the therapeutic method chosen has always been correct, but in the hope that by comparing our results with others, which have been and will be reported, a satisfactory method of treating this very difficult infection may be reached.

Six of the patients studied were infants, these cases are analyzed in Table I. This arbitrary separation of the problems presented in infants from those presented in older children is made because acute osteomyelitis in infancy calls for different therapeutic procedures (11), and is usually followed by less permanent disability. Fifteen patients between the ages of 3 and 16 years (Table II)

²Of the 11 children admitted to the Duke Hospital during the past 5 years with acute osteomyelitis who died and upon whom autopsies were performed 8 showed pneumonias or pulmonary abscesses which were thought to be due to the organisms of the osteomyelitis. 7 showed renal lesions. 6 showed cardiac lesions and there were 4 with metastatic bone lesions. In none of these cases was the vascular thrombosis described by Wlensky observed.

³We wish to thank Dr. Denzil Hart and Dr. A. R. Shands, Jr. for permission to follow and report these cases.

TABLE I—ACUTE OSTEOMYELITIS OF THE UPPER END OF THE FEMUR IN INFANTS LESS THAN 2 YEARS OF AGE

History No. Age, months Sex	Duration of symptoms prior to operation days	Foci of infection Trauma T (on admission) White blood count	Blood culture	Operation	Traction Cast	Culture from femur or hip	Length of follow up	End result
13137 20 Male	6	Upper respiratory infection—varicella Fall 39.4 degrees C 20 000	Staphylococcus aureus	Drainage of subperiosteal abscess upper end of femur	T	Staphylo- coccus aureus	Died 4 days after opera- tion	Died. No autopsy
13016 11 Male	21	Erysipelas None 39.6 degrees C 14 200	Beta hemolytic streptococcus	Drainage of pyarthrosis hip	T followed by C 4 mo	Beta hemolytic strep- tococcus	5 months	Sinus healed. hip mobile no shortening x ray, decalcification of neck of femur
15565 12 Male	13	Upper respiratory infection None 41 degrees C 15 400	Staphylococcus aureus	Drainage of pyarthrosis hip	T followed by C	Staphylo- coccus aureus	2 months	Sinus healed. hip mobile no shortening. no x ray
10631 19 Male	24	Upper respiratory infection None 39.6 degrees C 25 800	No growth	Drainage of soft tissue abscess of thigh	T	Staphylo- coccus aureus	Died 8 days after opera- tion	Died. Autopsy, acute osteomyelitis of the upper end of the femur. very early abscesses in the kidneys, the lungs and the liver
27210 17 Female	15	Upper respiratory infection None 38 degrees C 37 100	Bacillus Influenza	Drainage of soft tissue about hip joint	T	Bacillus Influenza	Died 15 days after opera- tion	Died. Autopsy, acute osteomyelitis of the neck of the femur. purulent arthritis. hip purulent meningitis. lobular pneumonia
78733 10 Female	28	Upper respiratory infection None 38 degrees C 24 000	Not taken	Drainage of pyarthrosis hip	T 2 mo	Staphylo- coccus aureus	Under treat- ment at present	2 months after onset treated by tract on at home. sinus healed x ray, destruction. neck of femur

were seen and form the subject matter for this report

DIAGNOSIS

It is difficult to make a diagnosis of acute osteomyelitis of the upper end of the femur in the early stages of the illness. The infection originates in a bone covered by a large muscle mass, the child often is unable to localize his pain to a small area and may refer it to the general region of the hip, the thigh, or the knee. The examiner frequently cannot demonstrate tenderness limited to the bone, and he may find it very difficult to eliminate the numerous disorders which simulate primary involvement of the upper end of the femur. Moreover, the clinical picture of a lesion which begins in the metaphysis of the neck and is complicated by early infection of the hip joint differs from that presented by the patient with a primary focus in the metaphysis opposite the greater or lesser trochanter, which does not extend to cause a pyarthrosis of the hip. Also, the formation of a soft tissue abscess from extension of a sub

periosteal or hip joint infection may still further alter the features of the case. To determine accurately the status of a given patient, it is not only necessary to make a diagnosis of osteomyelitis of the upper femur but it is also important to know the exact site of the primary focus and its subsequent extension.

The symptoms and signs presented by an acute osteomyelitis developing on the metaphyseal side of the capital epiphyseal plate of the femur are well illustrated by the following case.

W. E. (No. 71223), a white boy 13 years of age was admitted to the Duke Hospital on August 6, 1936 complaining of pain in the left thigh. Six days previously he had noticed a furuncle on the inner aspect of the left thigh and 2 days later he had a chill and developed severe pain in the left thigh. 1 or 4 days prior to entry he remained in bed with an elevated temperature of 103 to 104 degrees F., and complained constantly of pain in the left thigh and hip although he could move the hip without adding greatly to his discomfort.

Physical examination on admission revealed an acutely ill white boy with a temperature of 39.8

degrees C (103.5 degrees F), a pulse of 110, and respiration of 22. He complained bitterly of pain in the left groin which radiated down the thigh to the inner aspect of the knee. There was a healing furuncle on the medial aspect of the left mid thigh and another on the dorsum of the right wrist. There were numerous dental cavities, the pharynx was injected, and the tonsils were enlarged and inflamed. Deep pressure elicited tenderness over the neck of the left femur in Scarpa's triangle, however, there was little if any tenderness over the trochanter or the neck of the femur posteriorly. The left hip could be moved through an almost normal range of motion when the maneuver was performed slowly. The patient was as comfortable when the thigh was extended as when it was flexed.

Studies of the blood showed hemoglobin, 100 per cent, white blood count, 8,400. Differential polymorphonuclears, 85 per cent (segmented, 58 per cent, stab, 26, J forms, 1 per cent). The urine examination was negative and a blood culture taken on admission showed after 48 hours a growth of hemolytic *Staphylococcus aureus*. Roentgenograms of the pelvis and femora showed no bone abnormality.

A tentative diagnosis of acute osteomyelitis of the upper end of the left femur was made and skin traction was applied to the patient's left leg to await localizing signs before resorting to operation. This conservative measure (a transfusion was given also and fluids were forced) resulted in some relief of his pain, the temperature, however, remained elevated and the blood picture did not change. Three days after admission he suddenly began to complain of more severe pain in the hip and asked for the traction to be removed as he felt more comfortable with the left thigh flexed. Examination at this time showed tenderness on pressure over the neck of the left femur anteriorly in Scarpa's triangle, and marked tenderness on pressure over the trochanter as well. When the traction was removed he held the left thigh flexed, abducted, and slightly externally rotated. The muscles about the hip joint were spastic and any attempt to move the left thigh at the hip caused marked pain and voluntary resistance.

At this time roentgenograms of the pelvis and femora were negative and the leucocyte count was 9,000. A diagnosis of pyarthrosis of the left hip secondary to extension of a primary focus at the capital epiphyseal line was made, and the patient was operated upon at once. The hip joint was found to be filled with thick yellow pus (from which hemolytic *Staphylococcus aureus* was cultured), and on the inferior aspect of the neck of the femur at the capital epiphyseal line a sinus could be seen where an abscess in the metaphysis beneath had perforated the synovia to infect the joint (Fig 4).

The close similarity in the clinical picture between a primary infection at the capital epiphyseal line and a lesion which originates at the epiphyseal line of the greater tro-

chanter makes it virtually impossible to differentiate clinically between the two in their early stages. Even after following such cases carefully over a period of years with roentgenograms at frequent intervals, one may be unable to determine which area is the site of the primary focus. A pyarthrosis of the hip may follow an infection originating either in the metaphysis opposite the capital epiphysis, or in that opposite the greater trochanter. The following case is an illustration of an acute osteomyelitis which from the available clinical and roentgenographic evidence started in the metaphysis opposite the greater trochanter and caused a secondary pyarthrosis of the hip.

B. S. (No. 8106), a white boy 9 years of age, was admitted to the Duke Hospital on September 30, 1931, with the complaint of severe pain in the upper right thigh which radiated to the inner aspect of the right knee. One week previously he had seemed listless and had had a dry cough. Two days later he first noted an aching pain in the right thigh which grew progressively more severe, and at this time he developed a temperature of 103 degrees to 104 degrees F which remained elevated until admission. For 2 days he limped about the house, but for the 48 hours immediately before entry he had remained in bed with the right thigh flexed.

Physical examination revealed an acutely ill white boy with a temperature of 40 degrees C (104 degrees F), a pulse of 122, and respiration of 26. The tonsils were large and red, the pharynx was injected, and the cervical lymph nodes were enlarged. He preferred to lie on his back with his right thigh flexed at the hip and slightly abducted. Any attempt to move the thigh passively encountered resistance and caused marked pain referred to the lower part of the thigh and the knee. There was tenderness over the entire upper thigh, greatest over the lateral aspect of the femur immediately below the greater trochanter.

Studies of the blood showed hemoglobin, 75 per cent, white blood count, 9,900. Differential polymorphonuclears, 81 per cent. The urine examination was negative but on a blood culture taken on admission there was a growth of *Staphylococcus aureus* within 24 hours. Roentgenograms of the pelvis and femora were negative. On aspiration of the right hip joint a small amount of turbid fluid was obtained which was negative for organisms on examination of a stained smear but which showed later a growth of *Staphylococcus aureus*.

A diagnosis of acute osteomyelitis of the upper end of the femur was made, and at operation, after the bone was exposed, perforator openings were made at the point of maximal tenderness below the greater trochanter. A pocket of necrotic bone and

TABLE II—ACUTE OSTEOMYELITIS OF THE UPPER END OF THE FEMUR IN CHILDREN OVER 2 YEARS OF AGE

History No. Age Years Sex	Duration of symptoms prior to operation days	Foci of infection Trauma T White blood count	Blood culture	Operation	Traction Cast	Culture from femur or hip	Length of follow up, years	End result
6802 Male	11	None demonstrable None 39.2 degrees C 10,500	Not taken	None	T 2 mo C 2 mo	Not taken	5	Walks with limp 1 1/2 inches shortening no motion at hip x ray bony ankylosis
16505 Male	11	Tonsillitis Blow over hip 39.6 degrees C 18,400	Staphylococcus aureus	None	T 1 mo C 5 mo	Aspiration of hip Staphylococcus aureus	3	Recurrence of acute symptoms 3 years after original infection at present infected quiescent walks with limp 1 1/2 inches shortening slight motion at hip x ray, destruction capital epiphysis
17007 Female	11	Pansinusitis None 39.6 degrees C 31,400	Staphylococcus aureus	None	T 1 mo C 3 mo	Not taken	5	Walks with marked limp ankylo- sis of hip dislocation of head of opposite femur
125 Female	3	None demonstrable None 40.3 degrees C 38,000	Not taken	Drilling neck of femur pus encountered necrotic bone drained	T 1 wk C 2 mo	Staphylococcus aureus	5	Walks without limp 1 inch shortening excellent motion at hip joint x ray destruction capital epiphysis
254 Female	4	Upper respiratory infection Fall on hip 39.6 degrees C 18,500	Staphylococcus aureus	Drilling neck of femur pus encountered necrotic bone drained	T 4 mo C none	Staphylococcus aureus	6	Walks with slight limp 1 inch shortening excellent motion at hip joint x ray partial destruction of capital epiphysis and shortening of neck of femur
8100 Male	10	Upper respiratory infection Fall on hip 40 degrees C 9,900	Staphylococcus aureus	Drilling of cancellous bone below trochanter necrotic bone drained	T 2 mo C 2 mo	Staphylococcus aureus	5 1/2	Walks with limp 1 inch shortening excellent motion at hip x ray areas of old bone destruction of intertrochanteric region and neck
17537 Male	5	None demonstrable Fall on hip 40.3 degrees C 16,000	Hemolytic staphylococcus aureus	Drilling neck of femur pus encountered area of necrotic bone drained	T 2 mo C 3 mo	Hemolytic Staphylococcus aureus	4	Chronic invalid due to chronic osteomyelitis multiple bone involvement including the upper ends of both femurs with ankylosis of both hips
21080 Male	8	Furunculosis Fall on hip 39.8 degrees C 17,800	Staphylococcus aureus	Drainage subperiosteal abscess about upper end of femur drilling femur below trochanter	T none C 4 mo	Staphylococcus aureus	4	Walks with limp 1 inch shortening fair motion at hip x ray destruction of capital epiphysis
7468 Female	28	None demonstrable None 38.1 degrees C 11,000	Not taken	Drainage subperiosteal abscess about upper end of femur drilling femur below trochanter	T 3 wk C 3 mo	Hemolytic Staphylococcus aureus	5	Walks with slight limp 1 inch shortening fair motion at hip x ray partial destruction capital epiphysis and neck of femur
53916 Male	10	None demonstrable Blow on thigh 40 degrees C 17,350	Hemolytic staphylococcus aureus	Drainage subperiosteal abscess about upper end of femur	T 10 da C none	Hemolytic Staphylococcus aureus	2	Walks without limp no shortening excellent motion at hip x ray old destruction of trochanteric region
5453 Male	9	Upper respiratory infection Fall on hip 39.4 degrees C 22,200	Hemolytic staphylococcus aureus	Drainage subperiosteal abscess about upper end of femur	T none C 4 mo	Hemolytic Staphylococcus aureus	1	Walks with crutches good functional results with shortening and good motion at hip first affected and opposite femur developed osteomyelitis died late with resultant stiff hip on opposite side
45325 Male	30	No focus demonstrable Strained hip 39.4 degrees C 27,000	Hemolytic staphylococcus aureus	Drainage subperiosteal and massive soft tissue abscess about upper end of femur	T 18 da C none	Hemolytic Staphylococcus aureus	Died	Died 18 days after admission and operation no autopsy clinical evidence of staphylococcal pneumonia and pleuropneumonia
44789 Male	28	None demonstrable Fall on thigh 39 degrees C 13,600	Not taken	Drainage pyarthrosis hip joint drilling neck of femur	T none C 8 mo	Hemolytic Staphylococcus aureus	2	Walks with limp 1 inch shortening hip ankylosed x ray destruction of capital epiphysis
54600 Female	8	No focus demonstrable Fall on thigh 40.4 degrees C 17,000	Hemolytic staphylococcus aureus	Drainage pyarthrosis hip joint	T 5 wk C 6 mo	Hemolytic Staphylococcus aureus	1	Walks with marked limp 1 inch shortening poor motion at hip chronic osteomyelitis upper end of femur
71223 Male	8	Furunculosis None 40.3 degrees C 8,400	Hemolytic staphylococcus aureus	Drainage pyarthrosis hip joint	T 6 wk C 9 mo	Hemolytic Staphylococcus aureus	1	Under treatment at present chronic osteomyelitis of upper end of femur

pus was encountered and the hip joint was not drained. Following operation the child's temperature, which had been elevated, gradually fell and remained normal after 10 days. The leg was kept in extension by means of skin traction for $2\frac{1}{2}$ months, and this was followed by the application of a plaster hip spica for $3\frac{1}{2}$ months. When this was removed 6 months after the onset of the infection, the incision had healed, and the patient has had no subsequent recurrence over a period of $5\frac{1}{2}$ years.

The roentgenograms made every week during the 82 days the patient was in the hospital showed an area of bone destruction about the metaphyseal side of the greater trochanter 3 weeks after the onset of symptoms. The bone destruction spread up toward the capital epiphysis, however, there was never any extensive involvement of the capital epiphyseal line whereas there was extensive decalcification (destruction) of the metaphysis opposite the greater trochanter (Fig 5). As the primary changes in the bone were above the operative drill hole the latter was not considered responsible for the progressive bone destruction. With healing there was no growth disturbance.

In the preceding case little fluid was obtained on aspiration of the hip, and the joint was not drained at operation. None the less, cultures of the fluid later showed a growth of *Staphylococcus aureus*, and subsequent roentgenograms have demonstrated some destruction of the articular surfaces of the hip joint. The patient belongs to the group of infections which originate in the metaphysis opposite the greater trochanter, cause varying degrees of destruction of the femoral neck, and give rise to a secondary pyarthrosis of the hip by extension through the adjacent synovia.

In contrast to the lesions which cause secondary involvement of the hip, as illustrated by the preceding cases, is that group of primary foci which originate in the metaphyses of the greater and lesser trochanter and do not extend to infect the hip joint. Osteomyelitis arising at any point in the upper femur may, of course, involve the entire neck and invade the hip joint, however, if the lesion is recognized early, adequate drainage may prevent joint extension and thus lessen the possibility of a subsequent ankylosis. The following case is one of that group in which the primary focus may occur in the metaphysis of the greater or lesser trochanter and is not followed by secondary joint infection.

G C (No 53916), a white boy 7 years of age, was admitted to Duke Hospital on June 13, 1935, with

the complaint of pain in the right thigh and fever which had been present for 5 days. The pain had been maximal just below the greater trochanter and had become progressively more severe. He had been unable to walk since the onset. Having been seen by his family physician during the epidemic of poliomyelitis he was admitted with the diagnosis of poliomyelitis.

Physical examination revealed an acutely ill white boy with a temperature of 40 degrees C (104 degrees F), a pulse of 130, and respiration of 26. The patient was lying flat in bed and was shielding his right thigh against any pressure. After his confidence had been gained he could be persuaded to move his thigh through a fair range of motion without pain, and there was no muscle spasm about the hip. The single consistent positive finding was marked tenderness over the upper third of the thigh, maximal on the lateral aspect below the greater trochanter.

Studies of the blood showed hemoglobin, 72 per cent white blood count, 9,000. Differential polymorphonuclears, 88 per cent. Examination of the urine was negative. A blood culture taken on admission showed a growth of hemolytic *Staphylococcus aureus* after 48 hours. Roentgenograms of the pelvis and femora were negative and the spinal fluid was normal. On aspiration of the hip no fluid was obtained.

A diagnosis of acute osteomyelitis of the upper femur was made, and at operation on incision of the subcutaneous tissue at the point of greatest tenderness below the trochanter, a subperiosteal abscess was encountered and drained. Subsequent roentgenograms showed an area of bone destruction in the metaphysis opposite the greater trochanter which extended into the intertrochanteric region. One month after operation the incision had healed, and 6 months later there was roentgenographic evidence of satisfactory healing of the bone in the diseased area (Fig 6). In this case the infection in the cancellous bone decompressed itself by the formation of a subperiosteal abscess and at operation the area of necrotic cortex through which the pus had made its way was easily removed with the thumb forceps.

Taken as a group, children who have a severe osteomyelitis of the upper end of the femur (as contrasted with the mild type of infection) have an acute onset with pain in the general region of the hip or thigh which often radiates to the medial aspect of the knee. There may be a history of antecedent injury of the extremity, and a respiratory infection, a furuncle, an infected laceration, or varicella pustule may suggest the probable source of the bacteremia which precedes the bone involvement. Occasionally there is a prodromal period characterized by malaise and general lassitude, and a chill may usher in the acute

illness. An elevation of temperature is noticed near the time the pain becomes severe. Although the child may limp for a few hours after the onset of symptoms, the pain becomes more severe and he soon goes to bed and resents and resists any attempt to move him or his painful limb. The appetite is lost, vomiting is not infrequent, and in infants diarrhea and convulsions are not uncommon.

Examination early in the illness may reveal a fretful, ill child who cannot localize his pain but who complains when the crib is jarred or when any attempt is made to touch or move the affected thigh. The temperature is elevated as a rule to between 38.8 degrees C (102 degrees F) and 41 degrees C (106 degrees F). After gaining the patient's cooperation, it may be possible to determine that there is definite tenderness over the neck of the femur in Scarpa's triangle, or medially or posteriorly or over the lateral aspect below the trochanter. Repeated efforts to locate a definite area of tenderness should be continued, in so far as the patient's condition will permit, until the examiner is convinced that his observations are accurate. Later in the course of the disease there is spasm of the muscles about the hip and as the joint becomes involved the thigh is held flexed, abducted, and slightly externally rotated. Any attempt to move the limb from this position causes pain and is resisted by the patient. Even at this time there is seldom any swelling of the region affected. When, however, a large subperiosteal abscess has formed or a soft tissue abscess has developed from extension of a pyarthrosis of the hip, then swelling of the thigh and buttock is the rule. For effectual treatment the clinical diagnosis should be made long before this stage is reached.

Laboratory procedures, while of assistance, cannot supplant accurate clinical observation. The leucocyte count usually is elevated, ranging from 10,000 to 30,000 white blood cells, but in a severe infection it may be low with an abnormally high proportion of non segmented cells (16). Routine examination of the urine as a rule is negative, however, the test for lipuria (Hedri's sign) (13) should be made, and if it is found positive it is of significance.

The roentgenograms of the pelvis and femora show no evidence of bone destruction until 2 weeks or more after the onset of symptoms, however, when the hip is involved secondarily, widening of the joint space is visible before the appearance of bone changes. A procedure of great aid in making the diagnosis, and at the same time in determining the extent of the infection, is aspiration of the hip joint, this should be carried out on all patients who are suspected of having acute osteomyelitis of the upper end of the femur. A needle of large caliber (No. 18) is introduced under local anesthesia along the anterior surface of the neck of the femur until the joint space is entered, and the aspirate may be studied by a stained smear and by culture. If frank pus is obtained, or if organisms are present on the smear, there is infection of the joint and the severity of the involvement may be gauged by the type of exudate present.

On the other hand, the absence of purulent fluid in the hip joint does not rule out acute osteomyelitis of the upper end of the femur, as cases without hip joint infection frequently occur. Nor does the presence of a pyarthrosis of the hip always point to a primary lesion in the femur, although this should be considered probable until it is proved to the contrary. A number of disorders closely simulate acute osteomyelitis of the femur and must be eliminated before a differential diagnosis can be made.

DIFFERENTIAL DIAGNOSIS

Primary pyarthrosis of the hip. Purulent arthritis of the hip due to the pneumococcus and to the gonococcus is of common occurrence and most frequently develops as a complication of an acute infection due to these organisms elsewhere in the body. A primary synovial infection of the hip joint by the streptococcus may not be rare, however, a pyarthrosis due to the Staphylococcus aureus is most often secondary to a focus in adjacent bone (5, 35). Hence, if pneumococci, gonococci, or streptococci are found in the fluid aspirated from the hip, the diagnosis of a primary joint infection may be considered probable. One reservation should be made with regard to the pyarthrosis caused by the

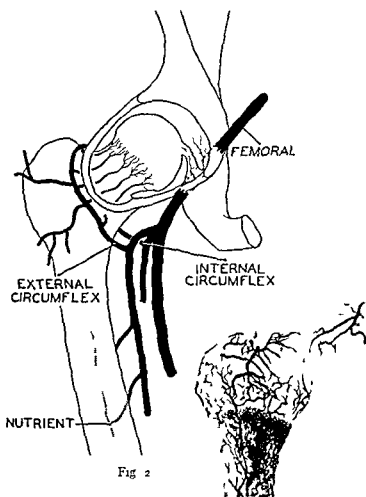


Fig 2

Fig 2 a left Diagrammatic representation of the major arterial blood supply of the upper end of the femur in an adolescent child (from dissection). The anastomosis between the branches of the internal and the external femoral circumflex arteries which encircle the neck of the femur provide a good source of blood supply to the epiphyseal line by branches which penetrate the capsule and lie along the neck of the femur beneath the synovia. b The vascular bed at the epiphyseal line of the upper end of the femur in an infant (after Lexer). The nutrient artery is a main source of blood supply for the epiphyseal vascular bed. Secondary sources are branches from the periosteal circulation and vessels which run in the round ligament.

Fig 3 A diagrammatic representation of the possible routes of extension of infections arising at different points in the metaphyses at the upper end of the femur.

Fig 4 W. E. (No 71223) Exposure at operation of the neck of the femur and of the capital epiphyseal line when draining a pyarthrosis of the hip secondary to an acute osteomyelitis of the upper end of the femur showing the point of rupture of the abscess in the metaphysis which had opened into the joint to cause the pyarthrosis.

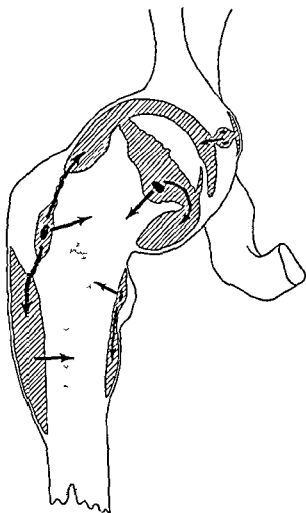


Fig 3

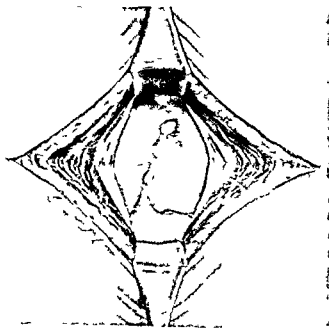


Fig 4

streptococcus, as a certain proportion of these purulent hip joints are also secondary to an acute osteomyelitis in adjacent bone. However, the streptococcus infections of the hip are well considered as one group, for when the diagnosis of joint involvement is made early, and the patients are treated by joint drainage



Fig 3 B S (No 3106) a left The patient 5 $\frac{1}{2}$ years after an acute staphylococcus osteomyelitis of the upper end of the right femur complicated by a pyarthrosis of the hip Drainage was provided by drilling the neck of the femur b Roentgenogram of the patient's pelvis 5 $\frac{1}{2}$ years after the acute infection showing the well preserved capital epiphysis with evidence of old bone destruction in the metaphysis opposite the greater trochanter The patient has a normal range of motion in the hip

and traction, the bone lesion decompresses itself into the joint and there is little bone destruction and subsequent disability (30) In the following case a primary streptococcal lesion of the neck of the femur drained spontaneously and was not treated by traction until 7 weeks after the onset of the infection yet a mobile hip joint was obtained in spite of extensive joint involvement

B S (No 21751) a white girl 7 years of age was admitted to the Duke Hospital on January 31 1933 Following an attack of otitis media she had suddenly developed severe pain in the left hip 7 weeks before admission For 2 weeks the pain in the hip which at times radiated to the left knee persisted and her temperature of 102 to 104 degrees F remained elevated A blood culture at this time showed a growth of hemolytic streptococcus Forty eight hours after the onset of the pain she kept her thigh flexed and resisted any attempt to move it Three and one half weeks after the onset of her illness an abscess in the soft tissue about the hip drained spontaneously The child kept the hip flexed and was brought to the hospital 7 weeks after the onset of acute symptoms because of her inability to extend the thigh

Examination revealed a pale ill looking, emaciated white girl 7 years of age The left hip was held flexed at 45 degrees slightly abducted and internally rotated Any attempt at manipulation

caused her to cry with pain Posterior to the greater trochanter, over the buttock, were scars of sinuses through which the abscess about the hip had drained spontaneously

Studies of the blood showed hemoglobin, 74 per cent white blood count 14,000 Examination of the urine was negative Roentgenograms of the pelvis and femora showed a destructive process in the neck of the left femur with epiphyseal separation and upward displacement of the shaft

The epiphyseal separation was reduced by traction, and after reduction the hip was immobilized in a plaster spica cast for 6 weeks For 6 months thereafter the patient used crutches At the present time 4 years after her illness she walks with a limp and has 2 centimeters of shortening of the left leg which can be corrected with a built up sole There is a satisfactory range of motion at the hip joint although the roentgenograms show absorption of the capital epiphysis and that the metaphysis of the neck of the femur articulates with the acetabulum (Fig 7)

A streptococcal infection at the capital metaphysis of the femur followed by a pyarthrosis of the hip is a not uncommon complication of otitis media in children (47, a) Purulent arthritis due to the streptococcus is best treated by early drainage of the joint (13, 43), traction, and subsequent immobilization if necessary Occasionally in the less severe

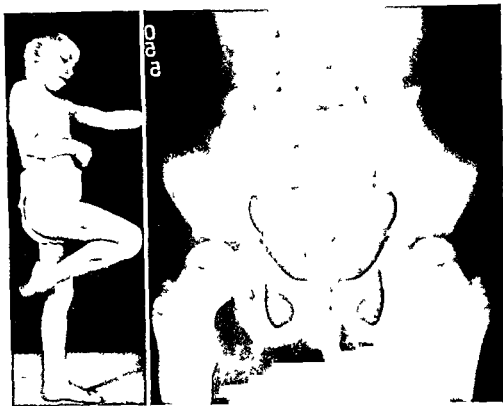


Fig 6 G C (No 53916) a left The patient 2 years after an acute staphylococcus osteomyelitis of the upper end of the right femur The primary focus in the metaphysis of the neck of the femur opposite the greater trochanter extended to form a subperiosteal abscess which was subsequently drained The hip was not involved by the infection and there is normal motion in the joint b Roentgenogram of the patient's pelvis taken 2 years after the acute infection showing a normal capital epiphysis with evidence of healed osteomyelitis in the intertrochanteric region

cases good results may be obtained by traction alone (47, a)

As the clinical picture of an acute pyarthrosis of the hip is so similar to that of an acute osteomyelitis of the upper end of the femur, the differential diagnosis between the two often depends on the information obtained on aspiration of the joint At times it may be necessary to follow the patient over a period of months before the final opinion is reached In this connection it is important to note that a primary synovial infection may show no bone destruction over a period of months except as a result of pressure after the articular surfaces have been damaged by the infection The following case of primary pneumococcus arthritis of the hip illustrates the absence of bone destruction in the presence of a hip joint infection of long standing

L H (No 50081) a colored infant was brought to the Duke Hospital on November 13 1935, with the complaint of swelling of the left thigh for 3

weeks, developing shortly after an attack of pneumonia The mother thought the patient had "some fever" throughout her illness

On examination the temperature was 39.5 degrees C (103 degrees F) The left thigh and buttock were swollen, hot and tender Any attempt to move the left leg caused the baby to cry out with pain

Studies of the blood showed hemoglobin 75 per cent white blood count, 18,600 Differential polymorphonuclears, 78 per cent The urine examination was negative Roentgenograms showed widening of the left hip with dislocation of the head of the femur above the acetabulum Aspiration of the hip joint yielded thick green pus from which pneumococcus type IV was cultured

The soft tissue abscess was drained, and at operation an opening into the hip joint was demonstrated Roentgenograms at frequent intervals over a period of 9 months after the acute illness have failed to reveal any area of destruction in the head or neck of the femur, and the capital epiphysis remained intact although attempts to keep the head in the acetabulum have been unsuccessful (Fig 8, a)

Acute osteomyelitis of the innominate bone and ilium Five patients with primary acute osteomyelitis of the ilium have been seen dur-



FIG. 1. B S (No 21751) a Left Roentgenogram of the patient's pelvis showing the destruction of the capital epiphysis of the left femur and the neck articulating with the acetabulum 4 years after an acute streptococcus osteomyelitis of the upper end of the femur. b The patient has a normal range of motion in the hip except for limitation of abduction.

ing the past 6 years. Four of these suffered from the acute diffuse type (27) of the disease with destruction of the acetabulum and involvement of the hip joint. In no case was the diagnosis made until the region of the hip joint was exposed at operation or until there was roentgenographic evidence of bone destruction. In reviewing the histories of our patients and of reported cases (2, 3, 41, 49) no significant difference was found in the symptoms presented by a patient with an acute process in the neck of the femur and one with a primary focus in the acetabular portion of the ilium. The finding, on physical examination, of an abscess in the internal iliac fossa or of marked tenderness over the inner table of the ilium on rectal examination has suggested the diagnosis of acute osteomyelitis of the ilium. At times tenderness has been demonstrated over the external table of the ilium and asymmetrical muscle spasm about the hip (19) or limitation of extension with retention of mobility at the hip joint (2) has suggested the presence of an iliac lesion. When, as in 3 of our patients, the hip joint was involved, however, the physical findings were so similar to those of acute osteomyelitis with secondary joint extension that the differential diagnosis was made only after

there was roentgenographic evidence of bone destruction in the ilium. Of some importance is the fact that acute osteomyelitis of the upper end of the femur is six times as frequent as a primary infection of the ilium.

Acute osteomyelitis of the ischium and pubis. Although the majority of the cases of osteomyelitis of the ischium and the pubis are subacute, and the patients frequently develop a pelvic, perineal, or inguinal abscess before they reach the surgeon, occasionally a fulminating infection of the acetabular portion of the ischium or the pubis will be seen. Thus, the usual patient with osteomyelitis of the pubis may complain of pain over the pubic ramus. The 3 patients with subacute osteomyelitis of the ischium who were seen during the period covered by this study had pain and tenderness about the upper medial portion of the thigh and perineal floor. In such cases a mass may be demonstrated arising from, or attached to, the pubis or the ischium. In contrast to this group, however, is the fulminating infection originating in the acetabular portion of the ischium or pubis. Such a case was a 10-year-old boy whose symptoms and signs so closely simulated those of acute osteomyelitis of the upper end of the femur that a differential diagnosis was not made until operation.



Fig 8 a left L H (No 50081) Roentgenogram of the pelvis of a $2\frac{1}{2}$ year old child 18 months after an acute pyarthrosis of the left hip due to pneumococcus type IV In spite of dislocation of the head of the femur there has not been complete destruction of the capital epiphysis and fragmentation of this structure is only recently beginning b, B G M (No 78733) Roentgenogram of the pelvis of

a 10 months old infant which was taken 3 months after a pyarthrosis of the right hip due to the Staphylococcus aureus (and probably secondary to an acute osteomyelitis of the neck of the femur) showing early destruction of the capital epiphysis which is characteristic of the staphylococcus hip infections secondary to a primary focus in the neck of the femur

B McI (No 66002), a white boy 10 years of age, was admitted to the hospital on April 20, 1936 complaining of pain in the left thigh which radiated to the knee For the 3 days since onset he had been in bed, unable to walk, and had an elevated temperature of 103 to 104 degrees F

Physical examination showed an acutely ill white boy 10 years of age lying in bed with the left thigh flexed and slightly externally rotated The left thigh was diffusely swollen with points of maximal tenderness present over the greater trochanter and the lateral aspect of the midthigh Any attempt to move the extremity caused severe pain

Studies of the blood showed hemoglobin, 85 per cent, white blood count, 12,900 Differential polymorphonuclears, 91 per cent Examination of the urine was negative, and a blood culture taken on admission showed a growth of hemolytic Staphylococcus aureus 24 hours later Roentgenograms of the pelvis and femora were negative

A tentative diagnosis of pyarthrosis of the left hip secondary to an adjacent osteomyelitis was made and the hip joint was aspirated without obtaining any fluid The neck of the femur was then explored without locating a focus of infection, and cultures of the bloody serum from the bone later showed no growth The child was returned to the ward and after skin traction was applied to the left leg he was given hemolytic Staphylococcus antitoxin and a blood transfusion

In spite of these measures the temperature remained elevated to between 40 and 41 degrees C (104 to 106 degrees F) and the child failed to improve He continued to have pain in the general region of the hip and no new area of local tenderness could be elicited It was thought advisable to explore the acetabular rim and 48 hours after admission a second operation was done At this time perforator openings were made in the margin of the acetabulum, and on the second attempt, anteriorly and above the neck of the femur a pocket of pus was encountered and drained The patient's convalescence thereafter was satisfactory, and 2 weeks later there was roentgenographic evidence of bone destruction in the acetabular portion of the pubis (Fig 9) Subsequently this infection involved the hip joint, however, extensive bone destruction was limited to the acetabular portion of the pubis The same clinical picture, and complication, could have been presented by an acute osteomyelitis of the acetabular portion of the ischium¹

Acute transient infections of the hip This group is composed of patients with pain in the hip, an elevation of temperature, and an increase in the number of leucocytes The onset

¹Since these cases were studied a 15 year old girl (No 82346) with an acute infection about the hip joint has been seen First diagnosed as an acute osteomyelitis of the upper femur the subsequent course of events demonstrated the original lesion to be in the ischium Drainage of the hip joint was followed by subsidence of the acute infection



Fig 9 B McI (No 66002) Roentgenogram of the pelvis showing early evidence of bone destruction in the pubis of a patient with symptoms and signs suggesting acute osteomyelitis of the upper end of the femur. Exploration of the femur on admission failed to expose the focus of infection. However prompt improvement followed drainage of the upper margin of the acetabulum at a second operation 2 days later.

of the condition usually is acute, and while the child may walk painfully with a limp for a short time he is soon more comfortable in bed with the thigh flexed. There are varying degrees of tenderness over the trochanter and the neck of the femur anteriorly and posteriorly. Movement of the thigh may cause pain but this is not so great as that present in a case of pyarthrosis of the hip and there is less muscle spasm about the joint than in the latter disorder. Aspiration of the hip joint usually yields negative findings. Treatment by means of skin traction applied to the affected extremity, plus general supportive measures usually affords rapid relief of symptoms. The pain becomes less and less severe and over a period of from 1 to 2 weeks the temperature falls to normal. Should the symptoms fluctuate in intensity and should multiple joint involvement supervene a diagnosis of acute rheumatic fever would suggest itself. If within 48 to 72 hours, the conservative therapy has not brought about great improvement in patient's symptoms and signs they will likely be found to be due to a more permanent lesion than an acute transient infection.

Subacute infections about the hip joint. This group of inflammatory lesions of the upper

end of the femur, hip joint, and pelvis are characterized by a more gradual onset, milder local symptoms, and less constitutional reaction than is the case in acute osteomyelitis. This difference in the severity of the symptoms and signs allows the physician more time to form an opinion as to the nature of the infection. The same diagnostic measures may be indicated as are applicable in the cases of acute infection, yet the subacute case may be treated conservatively without anxiety, at least for a time, while one awaits changes in the x-ray photograph or the development of a localized subperiosteal or soft tissue abscess. However, even in this group of patients the hip joint should be aspirated, as the information obtained helps to establish the diagnosis. Occasionally in the subacute infections it is impossible to differentiate between a pyogenic and a tuberculous lesion until a biopsy is done.

At times it may be necessary to exclude acute poliomyelitis, acute appendicitis, or acute metastatic psoas abscess (44) before a diagnosis of acute osteomyelitis of the upper end of the femur can be made. Elimination of such injuries as separation of the femoral epiphysis or dislocation of the hip may be indicated, and Legg-Perthes' disease occasionally may need to be ruled out. In all cases suggesting these diseases a careful study, including the usual diagnostic procedures, will enable a differential diagnosis to be made without great difficulty.

TREATMENT

A most important factor in the treatment of acute osteomyelitis of the femur is the time which elapses between the onset of symptoms and the establishment of the diagnosis (1, 26, 30, 44). Moreover, early diagnosis is important in securing a good end result not only in those patients with acute bone lesions but also in those with either primary or secondary pyarthroses of the hip. Nevertheless the need for careful determination of the patient's physical status, and adequate preparation for any operative procedure contemplated, is as great in this group of infections as in any acute surgical condition. During the period of observation which in many instances is necessary, the essential

studies may be done, the original impression confirmed by re-examination, and the patient's condition improved by the administration of fluids. The toxemia may be combated by a transfusion and the use of antisera (16), and the patient's pain frequently may be relieved by the application of skin traction to the extremity affected.

In most instances the history and physical examination alone will indicate a focus of infection in the region of the hip. The accessory examinations should include a study of the blood with a white blood count and a differential leucocyte count. Even in a severe toxemia the total number of white blood cells may be low, but the differential count with an increase in the proportion of non-segmented leucocytes may aid in gauging the toxemia. The urine, which should be examined especially for a lipuria (13), may give confirmatory evidence of a primary bone lesion. A routine blood culture on entry is indicated in every case suspected of having acute hematogenous osteomyelitis. The presence of a *Staphylococcus aureus* blood stream infection demonstrable within 24 hours after admission may add considerable weight to the clinical impression of a primary bone focus. Little assistance can be derived from the roentgenograms until 2 weeks after the onset of acute symptoms, and frequently more than 3 weeks elapse before there is definite evidence of bone destruction. When the hip is involved there may be widening of the joint space at a relatively earlier date.

Aspiration of the hip should be carried out on every patient who presents symptoms and signs that suggest the presence of an acute pyogenic infection in the region of the joint, and if fluid is obtained it should be studied by a stained smear and by culture. If examination of the stained smear is negative for organisms, a growth may appear on the culture after 24 hours. By this means the group of synovial infections due to the pneumococcus and gonococcus and those due to the streptococcus may be differentiated from the *Staphylococcus aureus* pyarthrosis, which is secondary to a focus in adjacent bone. Should pneumococci or streptococci be demonstrated on aspiration of the hip, prompt open drainage

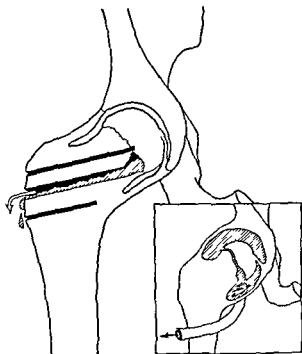


Fig 10 a, left Operative treatment of acute osteomyelitis of the upper end of the femur. Drill holes are made up through the neck to the capital epiphyseal line as represented. If pus is encountered the drill hole is enlarged with a perforator, or if the abscess is superficial the cortical bone is removed with a rongeur until adequate drainage is obtained. b, If a frank pyarthrosis of the hip is present, a rolled up strip of Penrose tubing is used to drain the joint.

of the joint with the application of skin traction to the affected extremity may be the treatment of choice. In addition to the usual supportive measures, antisera, immune transfusions (23), and sulfanilamide (27) may be of benefit. In our experience, unless traction is used in connection with other measures in hip joint infections due to the gonococcus, destruction of the articular cartilage occurs and is followed by ankylosis of the hip.

Should no fluid be obtained on aspiration of the hip, and if there is any question of the infection being acute and severe, it may be wise to apply skin traction to the leg and watch the child for 24 hours. At the end of this period the blood culture may show growth, better localizing signs may be present, and during this time it may be possible to improve the patient's general condition by the administration of fluids, a transfusion, or the use of antiserum (16). Lack of improvement at the end of this time or a positive blood culture of *Staphylococcus aureus* points to a primary focus, most probably in the neck of

the femur In the type of problem herein described and in the case with well defined localizing signs which can be diagnosed when first seen as an acute osteomyelitis of the upper end of the femur, the upper femur should be explored as soon as the patient's general condition warrants Although some (14) have advised the creation of a large opening through the neck of the femur, we think that exploratory drill holes through the neck and cancellous bone below it will serve to demonstrate any pocket of infection present, and, when gross pus is encountered, the small hole can be enlarged with a perforator (Fig 10) The method used for drilling the femoral neck provides for exploration of the metaphyseal area while disturbing as little as possible the blood supply of the epiphyses and the epiphyseal line (Fig 2) Should no gross infection be demonstrated, the operator is faced with the problem of exploring the acetabular margin or of awaiting the results of the cultures of the bloody fluid from the drill holes in the femur At this point it may be wise to confirm the previous hip joint findings by direct aspiration of the joint through the capsule exposed on the posterior aspect of the neck of the femur

The decision regarding exploration of the margin of the acetabulum should be made on the merits of the individual case We have failed to find a lesion in the neck of the femur or in the hip and have returned the patient to the ward only to explore the acetabulum 48 hours later when the patient failed to improve and when cultures from the femur were negative In other instances it may be wiser to proceed and explore the acetabulum at the initial operation Once a focus of infection is found it should be opened sufficiently wide with a perforator to relieve pressure and allow adequate subsequent drainage Especial operative procedures for treating acute infections of the ilium (2), ischium, and pubis (24) have been reported

If, on aspiration of the hip joint, *Staphylococcus aureus* is found, the joint infection is, very probably, secondary to a focus in adjacent bone, and the problem arises whether to drain the upper femur, or the hip joint, or both Drainage of the hip under these conditions has been advanced as the procedure of

choice (5, 15, 29, 34, 36, 43, 44) but there are no enthusiastic reports of the results obtained in the *Staphylococcus aureus* infections Drilling the neck of the femur has its advocates (1, 14, 30) and under certain conditions others advise draining the joint and drilling the femur as well (12, 34) From the short series herewith reported (Table II) no didactic statement of the optimum method can be made, however, we believe that if the patient's pain is not relieved by hip joint drainage, or if the signs of toxemia persist, the neck of the femur should be explored also

In this series of cases the patients who were seen and operated upon within the first 2 weeks after the onset of the acute symptoms showed less permanent disability and a lower mortality than those who came to treatment after that time We have not obtained satisfactory results in the patients in whom drainage of the hip joint was done, however, our experience with this procedure has been limited We are now draining the hip joint in all cases of joint involvement and hope at a future date to report our added experience

The best results are obtained in those patients with acute osteomyelitis of the upper end of the femur whose symptoms are recognized and treated by drainage of the bone focus before secondary involvement of the hip joint occurs

Following operation, skin traction should be applied to the affected extremity and the thigh should be kept in a partially abducted and slightly flexed position In older children the limb may be suspended in a Thomas splint with a Pearson attachment and the patient may be encouraged to move the leg Should the toxemia persist following operation, repeated transfusions (39) and the administration of staphylococcus antitoxin (16) have proved most beneficial A positive blood stream infection after adequate drainage of a lesion about one hip may suggest the presence of a metastatic focus, possibly in the upper end of the opposite femur as occurred in 2 of our cases

The progress of bone destruction may be followed best by roentgenograms of the pelvis and the upper end of the femur at intervals of from 7 to 10 days during the first 6 weeks of

the illness. The duration of the maintenance of traction must be determined individually in each case, however, when the hip joint is affected, traction should be continued for 6 weeks or longer. If the capital epiphysis should begin to separate or the head of the femur to dislocate, a plaster hip spica may be applied, keeping the patient's thigh abducted, slightly flexed, and slightly internally rotated. Immobilization in plaster following the use of traction usually is necessary in the majority of cases and should be maintained until there is good evidence of healing. Crutches, with or without a walking splint, may be used for several weeks before the patient is allowed to bear weight on the affected leg. Throughout this period efforts should be made to increase the mobility at the hip. Should shortening of the leg occur, a built-up (cork) sole may help correct a limp.

SUMMARY

1. A resumé of the historical, anatomical, and pathological aspects of acute osteomyelitis of the upper end of the femur is presented.

2. Twenty-one cases of acute osteomyelitis of the upper end of the femur are reported, of which 6 occurred in infants and 15 in children over 2 years of age.

3. The differential diagnosis is discussed and the value of aspiration of the hip joint as an aid in making the diagnosis is emphasized.

4. From the authors' experience they conclude that the treatment of choice in cases of acute osteomyelitis of the upper femur due to *Staphylococcus aureus* is early diagnosis and drainage of the bone lesion.

5. Supportive measures including antiserum and repeated transfusions are of value.

6. During the postoperative period traction followed by immobilization in a hip spica until there is evidence of bone healing has been found to give best results.

BIBLIOGRAPHY

1. WYSEWORTH, K. H. Diagnosis and treatment of acute osteomyelitis of the head and neck of the femur. *Am J Surg* 1931 12 80-84.
2. BADGLEY, C. L. Osteomyelitis of the ilium. *Arch Surg*, 1934 28 83-124.
3. BEARSE, C. Boston M & S J. 1924 190 883-886.
4. BECKER. Entgegnung auf das Referat des Herren Friedlaender ueber die Mikrokokken der acuten Osteomyelitis. *Deutsche med Wchnschr*, vol 10, 35.
5. BECKMAN, F. Acute hematogenous osteomyelitis, its pathology with especial reference to involvement of joints its diagnosis and present day concepts of treatment. *Bull New York Acad Med*, 1930, 6 792-807.
6. BICK, I. D. G. A. History and Source Book of Orthopedic Surgery. New York John S Swift & Co., 1933.
7. CALDWELL, G. A. Acute suppurative conditions of the hip joint. *J Am M Ass* 1932 98 37-40.
8. DOILMAN, C. E. Pathogenic and antigenic properties of staphylococcus toxin. *Canadian Pub Health J*, 1932, 23 125-132.
9. GARRISON, FIELDING H. An Introduction to the History of Medicine. Philadelphia W B Saunders Co., 1929.
10. GRAY, H. *Anatomy Descriptive and Applied*. 4th ed. Re edited by W H Lewis. Philadelphia Lea & Febiger 1924.
11. GRIER, W. T., and SHANNON, J. G. Osteomyelitis of infants a disease that is different from osteomyelitis of older children. *Arch Surg* 1936, 32 462-493.
12. HART, V. L. Acute hematogenous osteomyelitis in children. *J Am M Ass* 1937 108 524-528.
13. HEDRI, ANDREAS. Wann und wie soll die Osteomyelitis im acute Stadium operiert werden? *Zentralbl f Chir*, 1925 52 1412-1416.
14. HUNTINGTON, T. W. The early operative treatment of osteomyelitis in the femoral head and neck. *Surg Gynec & Obst*, 1906 2 406-410.
15. INGE, G. A., and LIEBOLT, F. L. The treatment of acute suppurative arthritis. A report of thirty six cases treated by operation. *Surg, Gynec & Obst*, 1935 60 86-101.
16. JOYNER, A. L. and SMITH, D. T. Acute staphylococcus osteomyelitis. The use of staphylococcus anti-toxin as an aid to the management of toxemia and staphylococemia. *Surg, Gynec & Obst*, 1936, 63 1-6.
17. KOLODNY, ANATOLE. The architecture and the blood supply of the head and neck of the femur and their importance in the pathology of fractures of the neck. *J Bone & Joint Surg*, 1925 7 575-597. The relation of the bone marrow to the lymphatic system. Its rôle in the spreading of carcinomatous metastases throughout the skeleton. *Arch Surg*, 1925 11 690-707.
18. KUHN, JOHN G. Lymphatic drainage of joints. *Arch Surg*, 1933, 27 145-391.
19. KULOWSKI, JACOB. Pyogenic osteomyelitis of the pelvis. *South M J*, 1936, 29 994-998.
20. LANGDON, F. W. J. Cincinnati Society of Natural History 1881, Vol 3. Quoted by Reasoner, M. A. Prehistoric and ancient disease. *Military Surg*, 1929, 65 339-363.
21. LEXER, ERICH. Zur experimentellen Erzeugung osteomyelitischer Herde. *Arch f klin Chir*, 1896 48 181-198, *Osteomyelitis Experimente mit einem spontan beim Kaninchen vorkommenden Isterer reger Arch f klin Chir* 1896, 52 576-591. Untersuchungen ueber Knochenarterien 1904 (E. Lexer, Kuliga and Wolsky Turk.)
22. LONG, P. H. and BLISS, F. A. Para amino benzene sulphonamide and its derivatives. *J Am M Ass*, 1937, 108 32-37, *Arch Surg*, 1937, 34 350-359.

- 23 LYONS C Immunotransfusion and antitoxin therapy in hemolytic streptococcus infections J Am M Ass 1935 105 1972-1975
- 24 McWHORTER G L Osteomyelitis of the ischium and pubis Surg, Gynec & Obst 1929 49 205-212
- 25 MILLER O L Hip joint affections in children South M J 1928 21 289-293
- 26 MILLER R H Acute hematogenous osteomyelitis New England J M 1935 212 83-287
- 27 MONSIEGEON M De l'ostéomyélite aiguë de l'os iliaque Ann de méd et chir inf 1912 16 97 Quoted by Badgley C E loc cit
- 28 MOODIE ROY L Studies in paleopathology pleistocene luxations Am J Surg 1930 9 348-362
- 29 MOORE J E Osteomyelitis involving the hip joint A condition heretofore erroneously designated acute epiphysitis Ann Surg 1916 63 473-478
- 30 NATHAN P W Differential diagnosis and the treatment of acute osteomyelitis of the upper end of the femur involving the hip joint Surg Gynec & Obst 1932 54 52-80
- 31 NEUMANN E Ueber die Bedeutung des Knochenmarks fuer die Bluthildung Arch d Heilk 1869 vol 10
- 32 PASTEUR LOUIS De l'extension de la théorie des germes à l'étiologie de quelques maladies communes Compt rend Acad d sc 1880 1 1033
- 33 PHEMISTER DALLAS B The effect of pressure on articular surfaces in pyogenic and tuberculous arthritides and its bearing on treatment Ann Surg 1924 80 481-500
- 34 PYRAH L N and PAIR A B Acute infective osteomyelitis 262 cases Brit J Surg 1933 20 590-601
- 35 REICH R S Purulent arthritis J Bone & Joint Surg 1928 10 554-578
- 36 ROBERTSON D E Acute hematogenous osteomyelitis J Bone & Joint Surg 1927 9 8-23
- 37 ROSENBAUM J Beitræge zur Kenntniss der Osteomyelitis Deutsche Ztschr f Chir 1878 10 369
- 38 RUFFNER SIR MARC A Studies in the Paleopathology of Egypt University of Chicago Press 1921
- 39 SCOTT W J M The principles of the treatment of septicemia J Am M Ass 1935 105 1246-1249
- 40 SENN, NICOLAS Diseases of the Bones Dennis System of Surgery Vol 2, p 237 Philadelphia Lea Brothers & Co 1895
- 41 SHORT A R Acute osteomyelitis of the hum Dnt. M J 1931, 2 97-98
- 42 SHULZE WERNER Ueber die Ursachen der Bakterienablagerung im Knochen Arch. f klin Chir, 1933 177 451-466
- 43 SLOWICKA F A Purulent infections of the hip joint an analysis of 60 cases New England J Med 1915 212 672-6,6
- 44 SPEED K Acute epiphysitis at the upper end of the femur pathology and treatment South M J, 1928, 21 208-212
- 45 STARR CLARENCE L Acute hematogenous osteomyelitis Arch Surg, 1922 4 567-584 Osteomyelitis Lewis Practice of Surgery vol 2 Hagerstown, Md W F Prior Co 1931
- 46 WALMSLEY THOMAS The epiphysis of the head of the femur J Anat & Physiol 1915 49 434-440
- 47 WILENSKY, ABRAHAM O a The joint complications of acute osteomyelitis or acute epiphysitis, and principles underlying their treatment Ann. Surg 1927, 86 737-746, b Osteomyelitis, Its Pathogenesis Symptomatology and Treatment. New York The Macmillan Co 1934
- 48 WILSON J C and MCKEEVER F M Bone growth disturbances following hematogenous acute osteomyelitis J Am M Ass 1936, 107 1188-1197
- 49 YOUNG, F Acute osteomyelitis of the ilium. Surg Gynec & Obst 1934 58 986-994
- 50 ZEMANSKY A I JR., and LIPPMAN R K The importance of the vessels in the round ligament of the head of the femur during the period of growth Surg Gynec & Obst 1929 48 461-469

SOME SURGICAL ASPECTS OF TUBERCULOUS DISEASE OF THE ABDOMINAL LYMPHATIC GLANDS

G H COLT, M B, B Ch (Cantab), F R C S (Eng), London, England

G N CLARK, M B, Ch B (Aberd), F R C S (Eng), Alexandria, Egypt

AN INVESTIGATION into the pre-operative histories and postoperative results in 239 consecutive cases of caseous and calcareous abdominal lymphatic glands has brought together many points of interest. The patients were admitted into one of the wards of the Aberdeen Royal Infirmary during the 10 year period 1923 to 1932 and may be classified as follows

TABLE I

Nature of case	Traced or dead	Untraced	Males	Females	Totals
Caseous cases	26	2	21	17	38
Calcareous cases	144	22	91	75	166
Re-operation cases	31	4	15	20	35
Totals	201	28	127	112	239

The ward only exceptionally received patients under 12 years of age as these were referred to the Hospital for Sick Children. The ages of the 38 patients with the caseous type of the disease was considerably less than in the calcareous type. Apart from two of 36 and 52 years, they were under 29 years of age, and yielded an average of approximately 21 years with a median of 18½. Of 201 patients operated on for the calcareous type of the disease the average was just over 25 years of age and the median 23. Ten of the 38 patients with caseous glands, or more than a quarter, were between 11 and 15 years. This differs from Braithwaite's findings that

Between the ages of 10 and 15 years there appears to be a period when the disease is not commonly evident

It is possible that different ages of admission to hospital in different localities may explain this. Twenty-eight of the patients were resident in towns and 10 came from the country districts

Relative proportion of human and bovine bacilli. Golden and Reeves state that viable tubercle bacilli are not demonstrated in the majority of their cases of calcified nodes examined by routine methods, but that occasionally the guinea pig test is positive. They do not say whether the human or the bovine type of bacilli were found. In Edinburgh, Wang found that 9 of 10 cases of alimentary tuberculosis were due to the bovine strain of tubercle bacillus. Hart and Rabinowitsch in Germany obtained cultures from 6 cases of primary intestinal and mesenteric gland tuberculosis and found that 5 were bovine. Topley and Wilson divide the abdominal cases into 2 types primary and secondary. They write

Primary abdominal tuberculosis is almost invariably due to the bovine type, but secondary abdominal tuberculosis, which occurs most frequently as a late complication of pulmonary tuberculosis is generally due to the human type

Blacklock (3) found in 94 necropsies of children with primary lung tuberculosis, that all the infections were with the human type of bacillus, but that in 64 with primary abdominal tuberculosis, 54 (81.8 per cent) were infected with the bovine type. Apart from the 10 cases with actual or suspected pulmonary tuberculosis, and even in some of these, it may be assumed that most of the 239 cases were due to the bovine type of bacillus from infected milk.

Portal of infection (lesion of the gut). Still points out that in children there is very frequently tuberculous ulceration of the intestinal wall

Probably even in the mildest cases and in the earliest stage of *tabes mesenterica*, there is some tuberculous ulceration in nearly all cases. My own figures made whilst I was pathologist at the Children's Hospital showed that of 132 cases with tu-

tuberculous enlargement of the mesenteric glands 107, that is over 80 per cent shewed ulceration of the bowel

He goes on to say that this ulceration should give bacilli in the stools and that bacteriological examination sometimes yields conclusive proof of the presence of tuberculosis Again

The frequency of abdominal tuberculosis there fore although it is a matter chiefly of pathological observation has a practical significance as a manifestation of the tendency to rapid and wide dissemination of tubercle in a child

In only one of our cases was an examination of the stools made for tubercle bacilli and it was negative

Blacklock (loc cit) writes

Primary tuberculous lesions were found in the abdomen in 82 (39 per cent) of the 2126 cases under three and in 41 (11 per cent) of 374 over this age

As regards the type of primary lesions in this series it was found that intestinal ulceration with caseation of the mesenteric glands occurred in 22 instances All these cases were fatal and the majority occurred in cases under 3 In the remaining 101 cases though the mesenteric gland were tuberculous no naked eye evidence of intestinal ulceration was noted

Apart from the various external constrictions produced in the bowel by the development of peritoneal adhesions we found no evidence of the development of strictures of the gut itself i.e. strictures resulting from the healing of tuberculous ulcers of the mucosa It must be assumed therefore that in the patients who survive, the bacilli have reached the glands without producing any permanent gross lesion of the bowel Many others have noticed this and experimental evidence supports it Lymphatic spread from elsewhere is out of the question in most of these cases Presumably the tubercle bacilli either pass through the gut without producing any demonstrable lesion in it or such lesion heals well Similarly glandular tuberculosis in the neck may arise with no apparent (tonsillar) lesion

The appendix was the only part of the gut examined on its internal surface and also microscopically It may be endowed with a special degree of resistance by its lymphoid tissue Small lesions of the ileum might have

escaped detection There was only one case of tuberculosis of the ileum during the 10 years under review It has not been included in the series

The patient was a male (aged 2 years) who died from emaciation and pyrexia 8 months after a resection of a diseased ileum The glands were very extensively affected with tuberculosis both in the caseous and calcareous stages

Cases of cecal tuberculosis are not rare, but none was seen in this series Healed lesions of the cecum and especially of the right colon would be difficult to exclude unless they were indurated Lesions of the lower ileum are easily detected It is not supposed that there was no initial bowel lesion, but no lesion was detected at operation

The atrophic appendix An atrophic appendix was suggested by Corner in 1905 as possible evidence of a healed primary lesion He had operated on a male (aged 41 years), and found an atrophic appendix and a caseous mass the size of a walnut Commenting on this he wrote

The case just related illustrates the coexistence of an atrophic appendix and a large caseous gland in the mesentery of the small intestine It is possible that they represent indirectly the primary and secondary effects of the same disease The tuberculous lesion in the intestine may have left no other mark behind it than the atrophic appendix

This relationship does not seem to be borne out by facts It would be expected that, in an occasional case at least, signs of active tuberculosis would be found in the appendix, as is found in from 5 per cent (Howarth and Gloyne) to 35 per cent (Mitchell) of tonsils Out of the 93 appendices examined microscopically from patients who had caseous and calcareous mesenteric glands only one possibly tuberculous appendix was found and this was doubtful Many atrophic appendices also are found without any sign of abdominal tuberculosis An arresting fact is that the atrophy begins distally and commonly results in obliteration of the lumen there

It is possible that if the atrophic appendix represents the end results of old tuberculous appendicitis, of which fact no serial evidence has yet been published as far as we know, the bacilli are absorbed directly into the lymph

phatic system during the acute or subacute inflammatory stage. Later no sign of tuberculosis of the appendix itself is demonstrable. Alternatively recurrent attacks of non-tuberculous, appendicular inflammation stimulate glands already tuberculous to become caseous, and later on they calcify. Appendicular inflammation is associated with caseation in about half the number (Colt and Clark, 11). This view of the matter is new as far as we know, and seems to fit the facts better than the suggestion first made by Corner. The absence of tuberculous lesions in the appendix supports it and also the fact that a distally atrophic appendix, or an appendix showing signs of chronic inflammation, is found in such a large proportion of calcareous gland cases. Of 172 cases of caseous and calcareous mesenteric glands in this series, where the condition of the appendix has been noted, 112 showed either atrophic or chronic appendicitis—a percentage of 65, which is very remarkable. Of these 19 were of the atrophic type and probably there were many more included in the chronic variety but were not specifically noted as such.

Theories of calcification. Klotz's theory of calcification whereby the fat in the caseous material is broken up and forms calcium soap to be replaced later by calcium phosphate and carbonate is generally accepted. There is about nine times as much phosphate as carbonate. The tendency to calcification would appear to be more marked in the abdomen than elsewhere in the body, but the cause of this is not clear. In the commonest situation for chronic tuberculosis, viz., the lungs, calcification seldom occurs. The hilar glands are frequently affected with tuberculosis, and in children they often caseate, yet x-ray examination seldom shows calcification. The difficulties of examination of the chest as compared with the abdomen must be taken into account. At postmortem examination calcification is not seen with any great frequency and when present is small in amount. Muir writes

In our experience however, a subpleural healed or calcified nodule in some part of the lung other than the apex is relatively rare, as are also calcified bronchial glands.

Blacklock's (2) observations support this. Assuming Klotz's theory to be correct, an explanation of the frequent occurrence of the calcification in the mesenteric glands lies in the fact that they are likely to have a greater intermittent supply of fat than the other glands of the body. The fat after absorption has to traverse the glands before it reaches the receptaculum chyli and is perhaps broken up in the process. Yet another possibility is that as the glands are in the portal circulation, the venous blood influences the process. Its composition must be different from that in the general circulation after the excretion of the alkaline succus entericus and the absorption of acid substances from the bowel. This would fit in with the theory of Wells who criticizes Klotz's theory and suggests that calcification depends on physicochemical processes rather than on chemical reactions alone, calcium being present in the blood almost at saturation point and being held in solution by the colloids and carbon dioxide. In the region of dead tissues, where the tension of carbon dioxide is low, the blood is liable to deposit some of its contained calcium.

Rate of calcification. We are still largely ignorant of the rate at which calcification occurs. Caseation must take place first and from the study of cervical adenitis it would seem to be a very early process. Bruce, writing on tuberculous neck glands makes the statement

Ninety nine per cent of all glands which have persisted for three months and have attained the size of a hazel nut show signs of caseation when removed by dissection.

As caseation may occur without giving rise to any, or very few, and trivial symptoms the average length of histones is no real guide. Even if it were, there is the possibility that appendicular pain would confuse the issue. When the appendix is found to be normal at operation we are perhaps justified in some cases in assuming that the glands alone, cause the pain. In some of the cases under review, mesenteric glands were found in process of calcification. Two such cases are the following.

A female patient, aged 18 years, had had generalized abdominal pain on and off for a year, in

monthly attacks. The pain settled later in the right iliac fossa and was unrelated to the periods. It was felt also in the vagina and leg. The appendix was normal. The x ray showed the glands so clearly that calcification must have been fairly advanced.

A male, aged 29 years, who had suffered for 6 months from attacks of pain in the right iliac fossa had at operation caseous glands. These showed up on the x ray films and the microscopic examination showed them to be calcified.

A third case showed neither caseation nor calcification.

A male patient aged 22 years had severe pain a year previous to his operation. It was sufficient to double him up and lasted for 2 weeks. The pain recurred 3 months before the operation. The operation notes did not state the condition of the appendix unfortunately but there was a mass of mesenteric glands proved by section to be tuberculous and there was no sign of calcification.

In the absence of definite radiological information, it may be assumed that the majority of glands are well on the way to complete calcification at the end of a year after infection with tuberculosis. Many have probably commenced to calcify within half that time. Radiological evidence at intervals of a month in a series of patients of different ages would be most valuable. The dangers due to rupture of a gland or to the formation of adhesions and bands during caseation are considerable. Perhaps one of the greatest safeguards which the patient has against them is the patchy distribution of the areas affected. To the naked eye, and also in the x ray pictures of the condition, it is frequently seen that the masses of calcareous material are not in the first instance homogeneous but are distributed in many small centers which give the typical "speckled" appearance in the x ray film. Parts of the gland at this stage feel "shotty." These multiple areas of caseation are not likely to cause so much gross peritoneal reaction as would a single large caseating mass. The chance of a gland bursting is also lessened.

Calcified glands loose in the peritoneal cavity. Occasionally calcified glands are found lying free in the abdominal cavity. The most likely explanation of this is that the weight and movement of the gland gradually stretch the mesenteric covering until it is attached only

by a pedicle and eventually the pedicle gives way.

A female patient aged 29 years had had pains in the side for 4 years. They were dull and intermittent lasting for a day or so with a few weeks' interval. During the previous 5 weeks the pain had remained constantly in the right side and had been accompanied by repeated nausea and emesis. The right ovary was found to be prolapsed and the appendix showed signs of recent inflammation. A small calcified gland lay free in the pelvis. The patient reported that she had been in better health since the operation 8 years before had gained in weight and was free from any symptoms. The bowels were regular without aperients.

Calcified glands lying free in the pelvis have been found by one of us (G.H.C.) on 3 occasions during 11 years in a total of 2,541 abdominal operations, but in many of the upper abdominal cases, the pelvis was not examined through the wound. An appendix epiploica may become detached in a similar way (Colt, 9) and calcified uterine fibroids may also be extruded.

It is interesting to speculate on the pathology of a calcareous mass $\frac{3}{4}$ inch in diameter observed on the free border of the liver near the gall bladder in a woman, aged 28 years, who had had stabbing pain on and off in the lower abdomen with radiation to the left breast for 18 months. There were in addition some calcareous masses in the mesentery. Whether the original lesion was a caseating tubercle of the liver or, as would appear more likely, a mesenteric gland which by some means had become attached to the liver and, later, pulled away from the mesentery, it is impossible to say as it was not removed. The gall bladder was normal, and nothing in the previous history pointed to an explanation.

The cause of the symptoms. Carson (7) was emphatic that a diagnosis could be made from pain alone.

I believe that it is absolutely diagnostic. But the main symptom is pain and its character is absolutely typical. It is a sudden centralized abdominal pain severe enough to make the child cry lasting for about fifteen minutes or less relieved by pressure and hot applications, recurring perhaps two or three times a day and stopping as suddenly as it began so that in the intervals the patient is quite free. In some cases pains occur every day in others only at intervals of a month or so, the attack

lasting two or three days I do not know of any other disease in which pain of this type occurs

A strong odor of acetone in the breath is characteristic of even mild attacks and is independent of vomiting

Many surgeons have sought to explain how the symptoms are produced

Golden and Reeves state

The mechanism of the production of symptoms by tuberculous mesenteric lymphadenitis, in the absence of previously mentioned complications is not clear It should be emphasized that a solidly calcified node seems to be just as able to produce pain as uncalcified actively diseased nodes

They also mention the possibility of a nervous origin From the same paper other suggestions are that the symptoms are due to cicatrization (Klein), or to involvement of nerve trunks in adhesions (Kantor) Kiss has shown that the mesenteric lymph nodes are traversed by nerves Schloesman—quoted by Golden and Reeves—considers that the relief of pain following the operation is due to the severing of these nerve fibers and to the reduction of tension on the peritoneum, the colic-like nature of the pain indicating that the physiology of the intestine is abnormal The late H Tyrrell-Gray, quoted in Braithwaite's paper, suggests another cause for the pain

Inflammation of mesenteric glands, whether acute or chronic, may be associated with colic, which nearly always arises in the small intestine or the ileocolic angle The primary focus in the intestine may itself be responsible for the pain, as already described, but the glands themselves may also be responsible For the inhibitory segment of the peristaltic wave normally exerts a physiological degree of tension in the mesentery during its passage, and, in the presence of inflamed glands, drags on these and causes pain

In this series it is evident that there must only very rarely have been any lesion of the gut itself The tension exerted by the passage of the inhibitory wave must be very slight and if such minute changes were able to give rise to pain, the passage of the intestinal contents alone, especially if they were inspissated, would be a more likely factor The symptoms have been variously described by Auchincloss to pressure on the lymph and lacteal drainage, pressure on the blood vessels causing congest-

tion, pressure on the sympathetic and to reinfection (allergy) In fact there appears to be no one satisfactory explanation if a different theory is applied to each individual case The symptomatology may depend to some extent on the situation of the glands

The following are three typical histories which have been selected from the cases under review

A male, aged 21 years, at intervals of a day to 2 months for 1½ years had attacks of abdominal pain The pain started to the left of the umbilicus and a shooting pain went to the right The first attack was acute and lasted 3 minutes The pains were unrelated to food and were worse after a day's hard work There had been no emesis but for the last month there had been nausea The patient was more easily tired than he used to be His appetite was good and his bowels were regular His previous health had been good In the family history there was *nil ad rem* At operation in 1932, the appendix was found to be fibrosed throughout its length Two calcareous glands, one the size of a cherry and the other twice that size, were found in the mesentery of the ileum and were removed Appendicectomy was also done The questionnaire reply in 1934 was "Relieved of symptoms and better since operation"

A male, aged 28 years, for 4 years had suffered from midepigastric pain extending to the umbilicus, coming on 1½ to 2 hours after food He always had heaviness and discomfort after food with flatulence and nausea but no vomiting He had always suffered from constipation and required to take aperients regularly As a boy, he suffered from indigestion Recently he had lost weight He had a good appetite but was afraid to eat The general condition was good There was some slight tenderness and hyper-tonus of the muscles around the umbilicus The report of the barium meal was "D U +statum D U =one hour" One or two calcified masses were seen anterior and to the right of the fifth lumbar vertebra At operation a very marked sigmoid band was found and divided The cecum was very adherent to the lateral pelvic wall by old fibrous tissue The appendix showed distal atrophy but was otherwise greatly thickened There were small shotty glands and three large calcareous ones at the root of the mesentery The abdomen showed general evidence of old tuberculous peritonitis The pylorus was spasmodic The three large calcareous glands were removed, appendicectomy was performed, and 2 pints of saline left in the abdomen Three years afterward the patient was seen and said that he had been very well since the operation His appetite was good He had gained 6 pounds in weight The bowels acted regularly, very seldom missing a day He had no indigestion The scar was sound

Female, aged 28 years, had had right sided abdominal pain for 3 to 4 years Initially it was like a

strain worse on lifting heavy weights. There was a dragging pain always in the right iliac fossa, which lasted a day now and then. It was worse lately before periods and after food. There was no nausea or emesis. Bowels opened regularly. There was some frequency of micturition when pain was bad. Periods were regular. On examination there was found some tenderness with referred pain to the midepigastrie region on palpation over McBurney's point. At operation the appendix did not appear to be pathological. One calcareous mesenteric gland was found and removed and appendectomy was done. Four years after the operation the patient reported that she suffered from wind constipation and pain in the scar since a very bad attack of adhesions but that she had gained a stone in weight, was in better health than before the operation and had been relieved of her pain.

Intestinal obstruction caused by tuberculous abdominal glands. The potential dangers of intestinal obstruction caused by areas of peritoneal reaction becoming adherent to surrounding structures are well known. Two unusual findings in which multiple holes were found in the omentum and in the mesentery, probably caused by the separation of such firm adhesions, are not at all well known and would repay future investigation.

When the local tuberculous process is very active and a caseous gland ruptures local or general tuberculous peritonitis ensues. The rapidity with which perforation becomes sealed off may tend to obscure its occurrence. The following case is suggestive of this, and being one of generalized tuberculous peritonitis is not included in our totals.

A male aged 20 years suffering from left-sided knife-like abdominal pain which radiated to the other side and later settled down becoming a dull continuous ache was found at operation to have tuberculous peritonitis. The peritoneum was thick and tough. There was a large amount of free fluid in the abdomen. The whole of the mesentery of the small gut and the omentum were thickened. The gut was covered with small tubercles. Numbers of enlarged glands were present. The perforation in the gland was not found. The abdomen was closed without any operative measures except the removal of the fluid and a part of the omentum for examination. The condition of the appendix was not stated. The omentum microscopically was tuberculous. Five years later this patient reported that he was better in health, had been relieved of his symptoms, had lost only 2 pounds in weight, had a regular movement of the bowels without aperients and suffered not at all.

The point is also confirmed by Riseley, who records a case in which generalization occurred in 11 days.

The patient, a boy aged 9 years, was operated on for partial obstruction. The lower ileum was adherent to the ascending colon near the cecum and to a large perforated tuberculous gland in the mesentery. Several smaller mesenteric glands were present. The peritoneum was normal. The abdomen was re-opened on the eleventh day for signs of recurrent obstruction and a few fresh adhesions were freed. The whole peritoneum both visceral and parietal was found to be thickly studded with tubercles, several of which were excised and reported to be tuberculous. The patient was well 4 years later except for a hernia of the scar.

Apart from strangulation in external hernia, small gut obstruction is a comparatively rare condition. Internal hernias account for about half the cases and another quarter are due to bands and adhesions (Moss and McFetridge). The importance of tuberculous glands in this latter group must be considerable. Hurst states that bands and adhesions which result from local peritonitis are the commonest causes of acute intestinal obstruction in children and young adults. The following cases of intestinal obstruction due to tuberculous are included in our series.

Acute obstruction. There were 10 cases with 3 deaths. The ages of the patients are of interest from the point made in Carson's paper (6) that caseous glands are a frequent cause of intestinal obstruction in "young people." The ages were 12, 18, 19, 22 (2), 24, 29 (2), 35, and 62, the average age being 26.9 years and the median 23. One of the patients had a history of appendectomy 3 years previously, but at the second operation the appendix was found to be normal and the obstruction not connected with the old operation area. The first operation had been done for an appendix abscess. Another patient had had a pyloroplasty for a leaking duodenal ulcer 4 years previously, and this operation also appeared to be unconnected with the obstruction which was due to a caseous gland.

In 6 of the cases the glands were stated to be calcareous, in 3 caseous, and in 1 calcifying. All the obstructions were of the small gut. One patient had a condition of volvulus. The other cases were mostly due to internal stran-

gulation of the gut by bands adherent to the glands, to the mesentery in their vicinity, to the parietal peritoneum, to the omentum or more frequently, to the small gut itself. In 1 case the obstruction was due to the gut having become drawn up and kinked by the contraction of the mesentery which had become adherent to itself.

The glands causing obstruction were variously situated. One was in the transverse mesocolon, all the others were in the mesentery of the small gut, 3 were stated to be at the root of the mesentery, 2 being in the ileocecal angle, 1 at the middle of the mesentery, 1 at the "upper" part of the mesentery and in the other cases the exact position in the mesentery was not stated.

Four patients required operative treatment of the obstructed gut itself. Of these 1 patient recovered after resection of $3\frac{1}{2}$ inches of ileum. The others died. In 1 an enterostomy was done for gangrenous gut, in another a resection of 18 inches of ileum was done for gangrene, and in another, an entero-enterostomy for axial rotation of the lower end of the ileum was carried out.

Axial rotation of part of the intestine. This is a dangerous and difficult pathological condition to deal with and is caused by contraction of the fibrous tissue round a focus of inflammation attached to the wall of the gut. It is generally seen in the ileum where the gut is more movable and where a vascular, multiple distribution of tubercle along the ileocolic artery is common. The rotation seen in this series and in other cases has been anticlockwise, as one might expect from the anatomy there, and as much as one circle and three-quarters in amount which no one would expect. The operative unravelling is difficult and takes far too long to be warranted at any operation performed for acute or chronic obstruction. The gut may be seriously depleted of its blood supply and easily injured. The quick detection of the actual pathological condition is apt to be a very difficult matter, chiefly because it is not well known. If it is made out soon, a safe course to pursue, when the obstruction is only recent and the blood supply sufficient is to perform a lateral anastomosis between the small intestine and the

cecum or ascending colon. Later the loop of bowel may be removed if necessary. Such a loop in this region may become water-logged and in a case known to one of us (G H C) was felt by the patient to flop over from time to time. A large evacuation of watery feces followed this sensation. Removal of the loop of bowel resulted in cure. When, however, the obstruction is not of recent duration it will be necessary to perform a temporary enterostomy and later a resection. Such a resection should always follow the relief of the acute condition as soon as considered safe, because the loss of strength is rapidly progressive from day to day, and the active digestion of the skin of the abdominal wall is constantly present and difficult to prevent. The pain of this combined with the loss of nourishment can be permanently stopped only by a radical operation.

In the museum of Aberdeen University there is a specimen of the skin of the abdominal wall showing a large number of inflamed, warty processes caused by the action of the succus entericus continuing for 4 months. The pain had been severe. Resection of the fistula cured the patient.

One patient developed acute obstruction of the sigmoid after an operation in which a gland had been removed. The obstruction was due to the adhesion of the sigmoid to the site of a freed Lane's band in the lower ileum. A third operation was later required for a second obstruction which was due to adhesion of the bowel to the peritoneum near the scar of the second operation.

Symptomatology. The symptoms and signs were those usually found in acute obstruction. The duration ranged from 6 hours to 5 days, the average being 36 hours. Five of the patients had had similar attacks previously which were characterized by abdominal colic. Males were more frequently affected than females in the proportion of 7 to 3. The fifth day patient showed bluish discoloration around the umbilicus, which is also well-known to occur in some cases of ectopic gestation and acute pancreatitis.

In 3 cases the glands were removed at operation and all were calcareous. In 3 cases the glands were scraped and the cavity peri-

tonized—all were caseous. In 3 cases—all calcareous—the glands were not removed. In the other cases where the glands were calcifying there is no mention in the notes whether they were removed or not.

Acute obstruction of the appendix. There was 1 case in which the appendix was acutely obstructed by adhesions due to a tuberculous gland in the meso appendix.

The patient a male, aged 14 years, had suffered for a day from right sided abdominal pain with nausea and vomiting. At operation the cecum was found to be fixed at the level of the umbilicus. The appendix was inflamed and retrocecal. One inch from the base of the appendix there was an S shaped kink caused by adhesions between small tuberculous glands in the meso appendix. On undoing the kink in the specimen fecal material and pus poured from the whole length of the appendix. Six years later this patient was free from symptoms and in better health than before the operation.

Subacute obstruction. In addition to the 10 cases of acute obstruction there were 3 cases of partial or subacute obstruction. The ages of the patients were 16, 17, and 18 years. One had a partial volvulus, to the left of the small gut at the duodenojejunal junction, caused by a large mesenteric gland. A year previously he had had an attack of pain similar to the one which led to operation. The second had a coil of small gut passing through a loop between the omentum and a caseous mesenteric gland. There was no history of previous attacks of pain. The third was a patient who had had appendicectomy done successfully 2 years previously. At the second operation, the small gut was found to be obstructed by an adhesion to a calcified mesenteric gland for $1\frac{1}{2}$ inches. The appendicectomy scar was free from adhesions. The patient had had attacks which had occurred at intervals of 3 months, both before and after the appendicectomy, and these attacks were similar to the one for which he required operation.

Adhesions. The incidence of abdominal tuberculosis is much higher in the north than in the south of the British Isles. It would appear that in any consideration of "the adhesion problem," the facts found to be true for the south are not necessarily true for the north. Dingwall Fordyce in 1903, gives the following statistics:

Out of 23,930 children treated in the hospitals in Edinburgh and Glasgow, the percentage of cases with abdominal tuberculosis was 3.9. The figures for the North Eastern Hospital for Children in London were 10,538 with a percentage of 1.3 with abdominal tuberculosis. The figures for America are even lower, in 37,100 cases the percentage was 0.28.

It is probable that a tendency to adhesions is present in patients operated on for other abdominal conditions who have had a mild degree of tuberculosis of the abdomen in childhood. Adhesions were noted at operation in over a quarter of the total cases in the whole series of 239—caseous and calcareous. The majority were found in the cases which later required further operation. The liability to their formation is evidently much greater than in non tuberculous persons. Some of the adhesions were due to old appendicitis and were not of a nature likely to give rise to any obstructive lesions, for example, small bands and filmy adhesions were noted between the appendix and the cecum and the surrounding peritoneum.

Omentum adherent to scar. One very practical point noted almost invariably in the reoperation cases and well known to all surgeons, is the tendency for the omentum and bowel to adhere to the upper end of the scar, where operative trauma seems less likely to happen than at the lower end. It would be expected that if adhesions were due to the organization of blood or serum they would form at the lower end of the scar, as any effusion would tend to gravitate downward in the Fowler position, but as light adhesions may form very quickly and remain when this position is assumed soon after the operation, this may not be a valid objection. As the wounds were sewed up from below upward, it might have been that the peritoneum of the upper end was more difficult of access, had been less freed from the superficial structures, more difficult to close effectively and more easily bruised than at the lower end. It would thus be more liable to contract adhesions or even to gape slightly in a few days' time, leaving a bare area for the certain development of adhesions. But with good muscular relaxation these objections are not valid. When the peritoneum is opened in a patient suffering

from adhesions, or in any operation in which the abdomen has been opened previously, it is therefore advisable to do this at the lower end of the incision if a clear spot is not visible elsewhere, and with a knife in preference to scissors.

Potential obstruction Apart from the cases already given, some others may be briefly described to indicate the type of adhesions found as being potential sources of obstruction.

A female, aged 17 years, who had had a typical history of recurrent attacks of right sided abdominal pain over a period of 3 years was found at operation to have a retrocecal appendix which was definitely inflamed in the distal third. A band was found running from the right border of the omentum to the ileocecal angle where there were three shotty calcified mesenteric glands.

A female, aged 31 years, had suffered from right sided abdominal pain for 8 years coming on in attacks before her periods. The pain radiated to the right leg and was worse on exercise. At operation the appendix was found to be normal. The omentum was tracking toward the pelvis where it was adherent to a calcareous mesenteric gland in the lower loop of the ileum.

A female, aged 35 years, had left sided abdominal pain for 3 months. The pain was sharp and colic like and came on in attacks with nausea and emesis. The attacks were becoming more frequent. The pain had been felt recently in the right abdomen. Abdominal examination was negative apart from a positive Lockwood's sign (10). The roentgenogram showed a calcareous mass to the left of the fifth lumbar vertebra. The appendix was bound down and adherent to the bowel in a few places. There were calcareous mesenteric glands in the root of the mesentery of the lower ileum. The glands were removed, appendicectomy was done, the sigmoid band was divided and two pints of saline left in the abdomen. Two years later this patient reported that she was in better health, had been relieved of her symptoms and that the bowels moved regularly without aperients, but she suffered from loss of appetite and weakness.

A female, aged 31 years, had had an operation for a left inguinal hernia 8 years previously. She now complained of a swelling of a similar nature on the right side and of a dull constant ache in the small of the back passing down the back of the right leg. She was inclined to be constipated. A right paracentral incision was made, and there were found to be several adhesions between the coils of the small gut and two calcareous mesenteric glands about the size of chestnuts. One of these glands had a sharp spike on it.

A female, aged 49 years, had suffered from indigestion, constipation, and anorexia for 20 years worse for the last 6 months. She complained also of

a constricting feeling in the epigastrium accompanied by tenderness. Lockwood's sign was positive. There was a tender palpable mass in the right iliac fossa. At operation a large band was found connecting the base of the gall bladder with the mesentery. The stomach, duodenum, and gall bladder were normal. The appendix was thin and atrophic and adherent to the cecum. There was a large calcified gland in the mesentery of the lower loop of the ileum. Appendicectomy, division of the mesenteric and of the sigmoid bands, which was fairly well marked, excision of the mesenteric gland, and closure of the abdomen were done, leaving in 2 pints of saline. This patient reported 5 years later that she was "better in some ways," had gained in weight, had "not quite" been relieved of her symptoms, still required aperient medicines, and still suffered from occasional slight pain and "wind."

There is little doubt that adhesions in the chronically tuberculous abdomen are as common as they are rare after appendicular obstruction or a ruptured tubal gestation in an otherwise healthy person. These experiences have shown that they are in no way related to such rough usage of the peritoneum as is occasionally inevitable when the muscles are active during anesthesia. Neither do they seem to depend on the stage of activity of the tuberculous process. Intraperitoneal saline tends largely to prevent their formation, but in a few cases no such late beneficial effect is seen. The fluid distributes any traces of blood which still adhere to the coils of gut and also separates the coils for a time. This proceeding would appear to be unsound if the active parts of the glands were even slightly damaged during removal as it might incur the risk of general peritoneal tuberculosis. A patient who has required more than one operation for tuberculosis of the abdomen and remains with a bad result would be a good subject for a clinical test of papan (25).

Cases of appendicectomy followed later by operation for tuberculous abdominal glands and adhesions. In an area where tuberculous disease of the abdominal lymphatic glands is frequent, difficulties often occur in the diagnosis and treatment of other abdominal conditions. The common instance is appendicitis. There were 13 such patients and they all had had appendicectomy previous to the operation at which the glands were removed. Of the total, 4 were males and 9 were females.

Two were associated with caseous glands and the others with calcareous glands. It is remarkable that in 10 patients the ages were under 22 years, the 3 others being 29, 31, and 39 years. Six female patients required a third operation and one a fourth. In 7 of these cases, the right paracentral incision had been used, in 2 the gridiron, in 1 Battle's, in 1 an inguinal, and 2 were not specified. The smaller incisions are inadequate unless a definite acute condition of the appendix is found and may then also be inadequate if tuberculous abdominal glands are the cause of it. The fact that in 10 of the 13 cases operation was done elsewhere makes it difficult to criticize, as the commencement of the cases had not been seen. We were able to follow up all our own patients. No generalization can be offered unless it is that when in a young person the diagnosis of a supposed acute appendix is in doubt, the possibility of caseous or calcareous glands being the cause should be remembered, and if operation is performed the right paracentral incision should be used. This apparently adds somewhat to the risk run by the patient should acute appendicitis be the sole pathological condition (8).

Cases requiring more than one operation. Ten of 31 re-operation cases, chiefly the earlier ones, had been done at other hospitals or in other wards of the Infirmary, and it was diffi-

TABLE II—RE OPERATION CASES

	Type of operation	Traced	Untraced	Excellent	Good	Poor	Bad	Dead
Group I	1 Appendicectomy and glands	4	1	3				1
	2 Adhesions							
Group II	1 Appendicectomy and glands	3					3	
	2 Adhesions and glands							
Group III	1 Appendicectomy			1	1	1	1	
	2 Glands and adhesions	4						
Group IV	1 Appendicectomy							
	2 Glands and adhesions	5	1	2	2	2		
Group V	1 Appendicectomy and glands	2	2	1	1			
	2 Adhesions							
	3 Adhesions							
Remainder	(Various)	3		5		5	3	
Totals		31	4	12	4	7	7	1

cult accurately to collect all the required information. Some cases had followed the use of small lateral incisions for the appendicectomy when the symptoms had really been due to the glands.

Table II shows the cases grouped according to the sequence of the operation and results. Three of the bad results occur in Group II. All were females and suffered from marked constipation. The disease had been progressive. The one death was due to a flare up of old pulmonary tuberculosis.

The blood platelets in 6 of the cases were counted and the average was 504,000. There was apparently no great, if any, deviation from the normal.

The most usual sequence in these multiple cases was (a) an operation for appendix disease, (b) an operation for adhesions and the removal of calcareous glands, and (c) a last operation for adhesions or when there were only two operations, an initial appendicectomy and later a gland and adhesion operation, or an appendicectomy and gland removal initially followed later by an operation for adhesions.

One patient who had 5 operations commenced in 1925 with an appendicectomy and gland removal. In 1932 he had two operations, at both of which glands and adhesions were dealt with. In 1933 he had another operation for adhesions and glands. Finally, in 1934, he required a further operation for adhesions. He was seen 9 months after the last operation and still complained of abdominal pain limited to the right side of the abdomen, and occasional vomiting. He suffered from marked constipation. He did not consider that he had been relieved at all by his last operation, yet during the last month he had been decidedly better. The scar was sound and, apart from the abdomen being slightly distended, nothing abnormal could be made out. There was a psychological factor in this case as his home life was not so congenial as hospitalization. His general physique was excellent.

One patient developed a ventral hernia after the operation and it became strangulated 10 years later. The original incision had been a long and high one to explore the gall bladder and the patient was very obese.

Sigmoid bands Of the 38 cases of caseous glands, there were 13 with sigmoid bands noted at operation. Three were small, 5 were definite or present, 2 were well marked or prominent, and 3 were very marked. The average age was 20 years and the median 19. The sigmoid band cases were associated with calcareous or partly calcareous glands in 6 cases. There were 4 cases with atrophic appendices and the ages were 12, 12, 14, and 21 years. There was 1 case with a Lane's link and 1 with old perisplenitis.

Of the 184 cases of calcareous glands, there were 74 with sigmoid bands, 40 per cent. Of these, 44 were small, short or slight, 22 were present or definite, 9 were prominent, broad, long or moderate, 15 extensive, marked or fairly well marked, 2 were very well marked or extremely marked. There was 1 case with old perihepatitis, 8 cases with old perisplenitis, 3 with Jackson's membrane, 1 with a fold of Treves, and 4 with Lane's links. Sigmoid bands were, therefore, commoner in the calcareous cases than in the caseous and were better formed, which, according to our view, merely illustrates a later stage in the life of fibrous tissue.

In all cases the sigmoid band was divided where it was considered to be interfering with the mobility of the sigmoid. All other adhesive bands such as Lanes' bands, omental adhesions, adhesions between the loops of gut and mesenteric adhesions were likewise divided (Re operation cases are excluded in this group).

Histology of bands and adhesions In 6 cases, these bands and adhesions were examined for evidence of tuberculosis. Two sigmoid bands were negative for tubercle bacilli. Two omental bands were examined. Both were composed of organized fibrous tissue—one rather vascular. A jejunal band was examined and found to be composed of very vascular fibrous tissue. One Jackson's membrane was examined and no evidence of tuberculosis found.

Etiology A common sense explanation of the cause of sigmoid bands, Lane's bands and pelvic adhesions is that they are due to organization of fibrin left by the absorption of effusions and pools of lymph lying in the various

watersheds of the peritoneal cavity, such as the left concavity of the mesosigmoid. Even the usually accepted congenital origin may be explained by hydropertoneum during fetal life or in infancy. They show a chordal as well as a radial contracture in their fan-like distribution. On numerous occasions in this series (and in another series of some 1200 cases of chronic appendicitis), it has been possible to peel off the bands without injury to the peritoneum. This is notably the case when the history is a short one and when the bands are flattened sheets of pale pink or yellow, organizing fibrin. In cases of longer duration, in which firm fibrosis is present incorporated in the peritoneal surface, this is inevitably injured by removal of the band and has to be re-peritonized. There is evidence in some re operation cases that some degree of contraction may occur under the new peritoneal surface.

Jordan, in a paper dealing with fixation of the iliac colon by acquired bands writes

This fixation can be shown to begin very early, indeed in infancy, and is due to constipation. It is one of the earliest results of intestinal stasis. This early commencement of fixation has led surgeons to conclude that the fixation is congenital, whereas it is, undoubtedly, acquired.

The radiological demonstration in his paper should be consulted by those who have occasion to deal with these cases. Whether the stasis and constipation can be shown "significantly" to be due to old tuberculous peritonitis will be for future observers to decide. We may be able to produce some small amount of evidence when the analysis of the larger series referred to has been completed.

Enlargement of pyloric glands, etc Apart from spasm of the stomach and duodenum, glandular enlargements and thickenings may give rise to symptoms and signs of duodenal ulcer. At operation there is little difficulty in deciding the pathology in a typical ulcer or in a typical gland condition, but there is apt to be very great difficulty in some that are atypical. The mass is of so doubtful a nature, even after reducing some of the edema by pressure, that it is justifiable to open the duodenum. The x-ray diagnosis also depends largely on the abolition of spasm and may, in

consequence, be misleading. In this series we have had 12 cases in which doubt arose, and in another series duodenal ulcer had been confirmed radiologically in 13 cases, but when the duodenum was opened no ulcer could be seen. It is possible that these abnormal thickenings occur in cases of low grade, or of chronic but still active, abdominal tuberculosis, and attention is drawn to them so that others may be able to add their observations in the future.

Tuberculosis of the appendix Of 93 of the gland cases in which the appendix was examined microscopically, one was found to be tuberculous.

A female aged 16 years had lower abdominal pain commencing the day before her admission. There was a history of many previous attacks of less severity. The appendix contained concretions. There were calcified glands in the mesentery near the appendix and a small lutein cyst of the left ovary. The cyst was punctured, the glands removed, and appendicectomy was performed. The pathological report was "lymphoid deposits in mucosa very prominent and active; minute area histology suggestive of tuberculous appendicitis." This case was untraced and is included in Group IV of the calcareous cases.

In one adhesions case tubercle of the appendix was found.

A male aged 48 years was admitted on account of right sided abdominal pain of 6½ hours duration which was relieved. He was operated on some 3 months later for attacks of colic like pain in the right iliac fossa with a vague generalized abdominal ache, nausea and intractable constipation. Occasionally he had had very severe attacks of indigestion. At operation there was an extraordinarily well marked sigmoid band, marked chronic inflammation of the appendix which was completely adherent to the cecum; there were numerous pericecal adhesions which immobilized the cecum to the lateral pelvic wall by dense fibrous bands, one band ran from the lower ileum to the cecum. On section the appendix showed a medial stricture with a concentric ring of ulceration and marked distal atrophy. All the proximal coats were hypertrophied. The section showed the ulceration to be tuberculous. The sigmoid and also the ileal bands were divided, appendicectomy was performed and 2 pints of saline was left in the abdomen. Four years after the operation the patient stated that he was now in better health, had been relieved of his symptoms, had gained in weight and only occasionally suffered from heartburn.

Gangrenous appendicitis came on in a patient who was known to have tuberculosis of the right lung.

A female, aged 20 years, gave a 3 days history of abdominal pain of sudden onset becoming worse on the day of admission and accompanied by nausea. She had been in hospital before for a similar attack which subsided. At that time she remained in hospital 3 months and was treated as a tuberculous case. At operation, the appendix was found to be gangrenous, the omentum wrapping it round and shutting in an abscess. The cecum was edematous and showed signs of old inflammatory thickening. Appendicectomy without opening the abscess was done and the wound was closed with drainage. The report on the appendix was "chronic tuberculosis of the appendix with acute inflammatory changes." A week after the operation the wound was still discharging hemorrhagic fluid (containing lymphocytes) and the patient was having marked pyrexia. At the end of a month the wound had healed, and she was discharged to the hospital she had been in previously. Three months later she died of phthisis.

Comment on operative technique In order to test the results of this part of the work, every effort was made to secure personal continuity in the re-operation cases. By following up the cases every 3 months for many years, it was possible to ensure that few, if any, were missed unless they had left the district, and many of these were heard from.

The older teaching that it is inadvisable to remove caseous or calcified mesenteric glands does not apply with such force today. In this series the glands were removed whenever the condition of the patient warranted it.

The incision A right paramedian incision was generally used, the rectus being retracted outward. The height of the incision was variable depending on the position of the glands, the suspected presence of complications and on any other pathological conditions present, but was preferably subumbilical. Carson used a midline infra umbilical incision. In only a few cases, when glands were numerous or small or when the operation was undertaken for acute appendicitis, were they not removed. When they were situated in a dangerous position as regards the blood supply of the small gut, they were left at the time, but even in these cases they had often subsequently to be removed, especially when situated high up in the vertebral attachment of

the mesentery The subsequent histories of 2 such patients showed "much improvement" in 1 and in the other loss of weight, constipation, and backache

Care is always required The intimate relationship with the vessels and the fact that the latter may run through grooves on the gland surfaces or lie in tunnels between them make for danger The higher up in the mesentery, and the nearer the lumbar spine, the greater the care required The vessels are larger there and the greater depth in the abdomen makes the procedure troublesome Removal of the glands may leave a hole on each side of the mesenteric leaf and care must always be taken in closing it *Both sides must be inspected* to see that no raw area is left Carson in his paper emphasizes this "After removal of the glands the greatest care must be taken to sew up the incision in the serosa" The repair should be done radially to avoid shortening the mesentery The vessels are often densely adherent to the glands *The veins being thin and stretched* are especially difficult to avoid There was only one case in the series in which ligation of the vessels gave rise to any apparent disturbance of the circulation Usually the ligatures were lateral ones In one case only was there a spreading hematoma of the mesentery due to the bleeding being very free and the source difficult to find

In removing the glands it is advisable for the assistant to grasp the bowel and the mesentery between the fingers and thumb of one or both hands so as to hold the glands forward for the operator This may be difficult or impossible if a gland lies near the vertebrae or if the mesentery has become contracted Removal is commenced by cutting the peritoneum over the gland or sometimes at its side The peritoneum is dissected back with the knife, the cutting edge being held toward the gland The smaller vessels are secured as they are cut, and unless numerous, the forceps are left on until the dissection is finished Some may prefer to dissect out the glands with scissors, but a longer time is required though the bleeding is less The danger of tearing an adherent vein is greater by this method than by using a sharp knife A good

light is essential Fine linen is a good ligature and suture material for this work as it is less likely to slip than catgut The use of silk was discontinued in 1920 on account of its becoming rotten and uncertain when boiled with the slightest trace of alkali, and from its tendency to curl, whereas linen can be boiled many times in weak soda and water without deterioration It is remarkable how many vessels are cut even in the removal of a small inflamed gland, and it may be advisable to tie off a number of forceps before proceeding to the complete enucleation especially in the case of a large gland Great care should be exercised by the assistant to avoid putting any tension on the structures when the vessels are being tied or at any time later A point to be remembered is that with the mesentery on the stretch bleeding may not occur until the structures are relaxed and then it may be very free Tests should always be made Conversely, stretching the mesentery may eject a ligature from a short stump Carson states the difficulty mildly when he wrote "These operations may be very difficult and trying"

When caseation is present, or the gland relatively large, its content may be eviscerated, part of its capsule removed, and the edges closed and peritonized In some cases of acute obstruction, drainage of the abscess for a short time seems justified Some surgeons have advocated the use of omental grafts to cover any raw area left on the bowel wall and so prevent the formation of a sinus, especially when the gland is at the junction of bowel and mesentery There would not appear to be so much danger of sinus formation in the case of calcareous as in caseous cases The subsidence of inflammation allows a gland to resume its normal position in the mesentery at some distance from the gut itself

Of the 269 operations, 219 were done by one surgeon, 39 by another and the remaining 9 by deputy

Two of the patients had slightly keloid scars This does not give the true number because less than half of the patients were examined during the follow-up, the others being traced by questionnaire These keloids sub-

side with time independently of any radiation. In the cases in which patients had only been traced for a comparatively short period, less than a year, there were many complaints of burning, tingling or itchiness in the scars, some of which were keloid in the earlier stages, but there was no case with a scar which had remained permanently hyperesthetic. Glycerine relieves the itching.

Three patients in the series had ventral hernias in 1 after 1 operation, in 1 after 2 operations and in 1 after 3 operations. These were 3 cases of general weakness of the lower abdomen. One patient had an incipient right inguinal hernia after a right paracentral incision. In 6 cases there was widening of the skin but none of the deeper layers.

TABLE III—RESULTS OF OPERATIVE TREATMENT

Nature of case	Excellent	Good	Poor	Bad	Died	Total
Caseous	27	3	2		5	36
Calcareous	109	7	6	8	4	144
Re-operation	12	4	7	7	1	31
Totals	148	24	14	15	10	211

The 10 deaths are accounted for as shown in Table IV.

It is evident that the removal of tuberculous abdominal glands has not met with successful results in all cases, though it would seem that the results are better the more complete the removal especially if done in the intervals between attacks. Removal during the process of calcification seems to be unsatisfactory and tends to the formation of adhesions. If there is radiological evidence that calcification is still in progress the case should, if possible, be continued without operative interference and operation may not ultimately, be found necessary. It is to be hoped that the use of papain (25) in future cases will provide a welcome improvement.

Possibility of stirring up tuberculosis elsewhere. It has been suggested that the removal of these glands is likely to stir up old quiescent lesions either in the abdomen or elsewhere. One of Carson's patients developed phthisis and recovered, and another developed phthisis

and died 11 months after operation. There were 5 cases in this series which might point to this possibility.

CASE 1. A female aged 28 years died from phthisis 4 years after the gland operation. She had a very strong family history of tuberculosis—6 of the family of 10 had died of tuberculosis—4 of lung disease and 2 of intestinal. The patient had a caseating gland the size of a hen's egg. She had suffered from pulmonary tuberculosis for 3 years previous to her operation.

CASE 2. A male, aged 44 years, had cholecystectomy for stones. Several calcified glands in the ileocecal angle were removed. He developed phthisis and is now under treatment.

CASE 3. A female, aged 12 years, was suspected of lung tuberculosis. She took 2 years to convalesce from the operation at which a fairly large number of tuberculous glands were found and removed.

CASE 4. A male aged 34 years, died on the fifth day after operation for adhesions. Death was due to stirring up an old phthisis. The gland operation had been done 2 years previously.

CASE 5. A female aged 23 years was admitted to a medical ward for 6 months following the operation with tuberculosis of the lung. At operation a large calcareous gland was removed from the root of the mesentery.

A male aged 12 years had all types of tuberculous mesenteric glands as well as tubercles in the lower ileum. He died some time after the operation from phthisis.

The last patient is not included in the series. He had generalized peritoneal tuberculosis surrounding the glands and very many small glands in all stages of activity.

FAMILY HISTORY OF TUBERCULOSIS

1 J C aged 16 years, 1932, mother died of tuberculosis.

2 B W aged 34 years, 1932, mother and sister phthisical. Patient also had lesion of lung at time of operation, and treatment for lung disease 15 years previously. Father died of pulmonary tuberculosis.

3 J R aged 12 years, 1931 (brother of B R below, 1929) four of family all delicate in youth, with also a family history otherwise suspicious of tuberculosis.

4 B R aged 17 years, 1929 (sister of J R above).

5 E D aged 17 years, 1931, mother suffers from tuberculosis and there is a very strong family history of tuberculosis.

6 M P aged 23 years, 1931 (brother of W P below) suffered from calcareous glands in abdomen.

7 W P aged 23 years, 1925 (brother of M P above).

TABLE IV—TOTAL MORTALITY

Surg.	Age and index	Type of case	Type of operation	Cause of Death	Survival period
1	1 29 (F R 1932)	Caseous gland and 2 duodenal ulcers	Removal of gland and appendix posterior gastrojejunostomy	Septic peritonitis and paralytic ileus	1 wk
2	2 24 (R B 1931)	Caseous gland Small gut obstruction	Entero enterostomy gland scraped	Postoperative lobar pneumonia	1 day
3	3 52 (J Y 1928)	Caseous gland Acute appendicitis	Appendix and gland removed	Peritonitis	5 days
4	4 28 (G W 1932)	Caseating mass in mesentery	Appendix and part of mass removed	Postoperative shock	1 day
5	5 28 (E N 1935)	Caseating gland	Removal of gland and appendix	Phthisis	3 yrs
6	6 62 (W C 1925)	Calcareous glands acute intestinal strangulation	Resection of 18 inches of small gut	Postoperative shock	2 days
7	7 29 (J M 1932)	Intestinal strangulation Gangrene of gut Calcareous glands	Enterostomy	Postoperative shock	Few hrs
8	8 43 (J W 1929)	Calcareous glands Slight adhesions	Appendix and glands removed	Burst wound—postoperative peritonitis	11 days
9	9 15 (I C 1930)	Mitral stenosis Calcareous glands	Removal of glands and appendix	Postoperative hemiplegia Acute heart failure	2 yrs
10	10 32 (B W 1930)	Adhesions Calcareous glands Potential hernia of mesentery	Appendix and glands removed repair of mesentery		
	(B W 1932)	Postoperative adhesions	Freem. of adhesions	Flare up of phthisis	6 days

Total cases.

Total operations

Deaths due to operation 5 to strangulation 3 to phthisis 2 Total 10

239

269

8 A N, aged 8 years, 1929-30 (sister of W N below), suffered from calcareous abdominal glands and required a second operation for adhesions and glands

9 W N, age 12, 1928-29 (brother of A N above), also suffered from calcareous mesenteric glands and required 2 later operations for adhesions. One other member of the family died of tuberculous meningitis, others had been under treatment in a hospital for tuberculosis and an uncle had a tuberculous lung

10 M B, aged 12 years, 1925, brother had weak chest, very possibly tuberculous

11 E N, aged 28 years, 1925 Six of 10 brothers and sisters died of tuberculosis, 4 from disease of the lungs and 2 from intestinal disease Two of father's sisters also died of tuberculosis

Thus a more or less strong family history of tuberculosis was obtained in 11 cases Six of these cases were brother and sister from 3 families Five of the cases were suspected of extra-abdominal lesions and are included in the "personal history" series Six of 10 brothers and sisters died of tuberculosis and of the 6 deaths 2 were due to abdominal tuberculosis Another patient had almost as strong a history, the father died of tuberculosis and the mother and sister of the patient were phthisical

PERSONAL HISTORY OF TUBERCULOSIS

1 A L, aged 23 years, 1932 At the time of the operation was suspected of having renal tuberculosis

2 B W, aged 34 years, 1932 Was in convalescent home 15 years previously for phthisis Suspected to have lesions at right apex at time of operation Died 6 days after the operation from "flare up" of the old phthisis

3 M P, aged 23 years, 1931 X-ray examination at time of operation showed the left lung to be blurred ?fluid Postoperative treatment for 6 months for phthisis

4 J R, aged 12 years, 1931 Delicate in youth Prominent root shadows in x-ray films

5 W F, aged 42 years, 1931 X-ray films showed a blurred and mottled right apex with prominent root shadows

6 E D, aged 17 years, 1931 Always weakly and suspected of having phthisis X-ray examination showed very prominent root shadows and peribronchial fibrosis He had an abscess over the sacrum this year and it was suspected to be tuberculous

7 E F, aged 16 years, 1929 Had neck gland incision 7 years previously

8 B R, aged 17 years, 1929 Had cervical tuberculous adenitis as a child

9 D F, aged 16 years, 1929 Right apical lung disease Tuberculous

10 W N, aged 12 years, 1928 Had pleurisy twice Thin pale faced Some pulmonary fibrosis

shown in the x ray Was in hospital previously for 3 months and had latent tuberculosis

11 J M aged 47 years 1927 A 'pinner all his life Had pleurisy five times

12 G W, aged 28 years, 1926 Five years previously had had an operation for psoas abscess (This patient had a tuberculous salpingitis as well as calcareous glands)

13 J I, aged 19 years 1925 Evidence of chronic pleurisy right base

14 E N, aged 28 years 1925 Cough at times and a very strong family history of tuberculosis

There does not therefore appear to be a very marked liability to the development of the glandular type of abdominal tuberculosis coincidently with or following on other tuberculous lesions

Of the total number of 239 cases, there were only 14 patients who from their past histories, or from examination of their present condition were actually known or suspected to have had other tuberculous foci Of these, 10 were suspected to have had pulmonary tuberculosis which in 3 cases was still active Two had had operations for tuberculous neck glands, one a psoas abscess 5 years previously, and another was suspected of having a tuberculous kidney and epididymis at the time of the operation Thus of the series of cases there are only 4 patients or at most 4, in whom tuberculosis was present in an active state elsewhere than in the abdomen at the time the operation was performed

SUMMARY AND CONCLUSIONS

It appears from the literature that the glandular type of abdominal tuberculosis is a severe and often fatal disease in infants and young children notably when the bowel is ulcerated that in those that survive, or become infected later in life, the disease runs a natural course toward calcification and cure This course may be a troubled and dangerous one It is difficult to correlate the effect of any particular kind of treatment with the progress of calcification, but serial roentgenography may help to clarify this factor in the future

The cases of 239 patients admitted consecutively into a general surgical ward have been reviewed for this enquiry Family and personal histories of tuberculosis were given

in 25 cases, but in only 3 or at most 4 of them was tuberculosis present in an active state elsewhere than in the abdomen at the time of operation There appears to be very little danger of causing general or local tuberculosis by an operation for the removal of the majority of tuberculous abdominal lymphatic glands

Excluding one doubtful case, no evidence was found in the abdomen of the portal of infection

The administration of intraperitoneal saline at the conclusion of the operation tends to prevent the formation of adhesions in abdominal tuberculosis

The adhesion threshold in abdominal tuberculosis is a low one When the precautions in common use for minimizing operative trauma are adopted there is evidence that within such limits the formation of adhesions does not depend on peritoneal injury or on the stage of the disease

Re operation should be avoided if possible until 2 years have elapsed from the time of the last operation

The connection between the atrophic appendix and tuberculous abdominal glands is discussed

No tubercle bacilli have been found in the adhesions, sigmoid bands, omental bands or Jackson's membranes when they have been examined The formation of such bands and membranes is probably due to the organization of fibrin in pools and collections of lymph The various stages of their formation may easily be observed

Every effort should be continued to rid the milk supply in small districts and in large communities of active tubercle bacilli

REFERENCES

1. AUCHINCLOSS HUGH Ann Surg. 1930 91 407-414
2. BLACKLOCK J W S Medical Research Council special report 1932 No 172
3. Idem. Brit J Tuberc 1935 29 69-84
4. BRAITHWAITE L B Tuberculosis of glands in the ileocaecal angle a cause of pain in the right iliac fossa Brit J Surg 1926 13 439-457
5. BRUCE, G GORDON The pathology and treatment of cervical glands in children Brit M J 1929 p 1031
6. CARSON HERBERT W The Treatment of Tuberculous Peritonitis Modern Technique in Treatment 196 p 104

- 7 Idem The clinical aspects of tuberculous mesenteric glands Med Soc Tr, vol. 41, p 220
- 8 COLT, G H Brit J Surg, 1932, 20 78
- 9 Idem Three cases of torsion of appendix epiploica of sigmoid colon Brit J Surg, 1932, 19 508-510
- 10 Idem Brit M J, 1932, Nov 19 942
- 11 COLT, G H, and CLARK, G N Lancet, 1937, 1 125
- 12 CORNER, EDRED M Lancet, 1903, 2 1464-1465
- 13 DINGWALL FORDYCE, A Abdominal tuberculosis in young children Brit M J, 1909, Sept 18 761
- 14 GOLDEN R, and REEVES, R J The significance of calcified abdominal lymph nodes Am J Roentgenol, 1929, 22 305-317
- 15 HART and RABINOWITZ Quoted by A S Griffiths in "A System of Bacteriology," 1930, p 194
- 16 HOWARTH and GLOVE Lancet 1923, 1 1202
- 17 HURST, ARTHUR F Index of Differential Diagnosis of Main Symptoms (French) 4th ed p 167, 1928
- 18 JORDAN, ALFRED C Brit J Radiol, 1931, 4 New Series, No 44, Aug, 1931
- 19 KISS, F Ann d'Anat Path, 1931 8 701
- 20 MITCHELL, A P Brit M J, 1914, 1 125
- 21 MOSS, W, and McFETRIDGE, E M Acute intestinal obstruction, a comparative study of 511 cases Ann Surg, 1934, 100 160
- 22 MUIR, ROBERT Textbook of Pathology 1933, p 412
- 23 NAGEL Quoted by Odgers Duodenal diverticula Brit J Surg, 1929-1930, 17 592
- 24 OSCHNER, ALTON, and STORCK, A The prevention of peritoneal adhesions by papain Ann Surg, 1936, 104 736
- 25 RISELEY, EDWARD H The pre-operative diagnosis of tubercular mesenteric and retro peritoneal glands Boston M & S J, 1915, 172 253-257
- 26 STILL, G F Common Disorders and Diseases of Childhood, 5th ed, 1927
- 27 TOPLEY, W W C, and WILSON, G S The Principles of Bacteriology and Immunity 1931, p 814
- 28 TYRRILL GRAY, H. Obscure intestinal colic. Brit M J, 1922, 1 253
- 29 WANG Quoted by A S Griffiths A System of Bacteriology 1930, p 193
- 30 WELLS Quoted by MacCallum A Text book of Pathology 3d ed, 1924, p 110

CANCER OF THE BREAST

CHARLES C LUND, M D, F A C S, Boston, Massachusetts

IN PRESENTING this paper I want to pay a tribute to the late Robert B Greenough, whose recent death has resulted in one of the greatest possible losses to students of cancer and to surgeons in general. A very large part of my personal interest in, and knowledge of, cancer has been derived from his stimulating teaching. In writing this paper I have tried to make it as much as possible one that would meet with his hearty approval. As you will see I will quote extensively from his writings.

CURATIVE SURGERY

One would think that during the 43 years since Halsted published his great paper describing the essentials of an effective technique for operation for cancer of the breast his principles would have become either universally used or universally discarded. During the intervening years hundreds of papers have been published concerning the end results in patients who have undergone this or essentially similar operations. Very few papers have been published which show even approximately as good results when less radical operations have been done. Grace of Brooklyn, however, has recently published a paper in which he claims good results from local mastectomy. He claims 44 per cent of cures in 40 cases, but admits that 80 such operations were performed, and that the follow up is only 50 per cent complete. Obviously, although he does not say so, he made no serious attempt to get the end results on his failures by consulting the death records at either the city or state departments of vital statistics. Is it honest for a man to compile a table such as he has, in which he compares his percentages with those of Greenough and others (3, 4, 5, 6, 8, 9) who follow up over 90 per cent of their cases, and then to consider the remainder of his patients to be dead of the disease?

In addition to Grace many surgeons, and among them not a few other members of the American College of Surgeons, perform many non radical operations in an attempt to cure cancer. Many may honestly be confused by the fact that certain publications of prominent surgeons and pathologists have led them astray. An instance of how this may occur may be found in a very important paper by Allen Graham. This recent paper is used as an example and is not the sole instance that might be cited in this connection. He states, "In a small percentage of cases, simple mastectomy is adequate treatment provided the entire breast is removed. Needless to say, these are cases in which the process has not progressed to the formation of a gross tumor nodule." He then goes on to limit still further the cases in which he makes this recommendation by insisting on a complete gross examination by a competent pathologist to rule out gross tumor. This advice, therefore, applies to a very small number of patients who undergo operation primarily for some benign breast condition, and probably in many instances different pathologists would disagree as to the actual presence or non presence of cancer. This advice can do no harm if it is followed exactly as given. It is likely, however, that careless readers would not take in the qualifying statements, but would quote Graham as an authority for doing things of which he would completely disapprove. In the next paragraph he goes on to say, "That an amputation of the breast and axillary dissection without removal of the pectoral muscles is adequate treatment for a certain group of patients has been proved to our entire satisfaction." This group he later defines as "early cases without evidence of axillary metastases."

How about this? Two aspects of it will be discussed. First, can one tell by physical examination whether or not axillary metastases are present? In the more recent papers by the members of the staff of the Harvard Cancer Commission this particular point has not been

considered, but it was considered by Greenough and Taylor (6) Therefore, to secure a modern group of cases a consecutive series of 50 recent cases at the Huntington Memorial Hospital has been studied with this aspect in mind These cases are all examples of primary, operable breast cancer which was proved by pathological examination, and all these patients were operated upon promptly after physical examination had been completed The examinations were made by various members of the surgical staff, but in all cases the examiners had had at least 10 years' experience in tumor clinic work at the hospital and each had worked also at one or more of the following hospitals Massachusetts General, Boston City, Pondville, and Palmer Memorial The operations performed were all radical procedures and consisted of mastectomy, removal of both muscles, and of the axillary contents, all in one piece This study is shown in Table I

This table shows that the pre operative accuracy of diagnosis when glands were thought to be involved was 91 per cent and when they were thought not to be involved it was only 61 per cent A similar study was made by Greenough and Taylor (6) in 1934 from the cases at the Massachusetts General Hospital

In this instance it is likely that most of the recorded pre-operative examinations were made by house officers However, although the preponderant type of error is different, the errors of clinical estimation are essentially the same in percentage as in the later series Here the examinations were only 68 per cent correct when glands were thought to be involved and 79 per cent correct when they were thought not to be involved Table II shows both these series on a percentage basis

With these figures in mind it is clear that one cannot be at all sure on examination whether the nodes are involved It is admitted that perhaps half of the cases referred to would be considered so advanced by Graham that he would not consider saving the muscles, but the other half were certainly early cases, as I read his criteria, and the percentage of errors in such cases, while it might be smaller than the percentages tabulated, would still be sufficient to make one think that a radical operation is warranted because

TABLE I—CANCER OF THE BREAST, HUNTINGTON MEMORIAL HOSPITAL, 1931-1936 COMPARISON OF PHYSICAL EXAMINATION AND PATHOLOGICAL EXAMINATION OF AXILLARY LYMPH NODES

Physical examination	Pathological examination		Total
	Positive	Negative	
Positive	20	2	22
Negative	11	17	28
Total	31	19	50

TABLE II—CANCER OF THE BREAST, ACCURACY OF PRE-OPERATIVE DIAGNOSIS OF AXILLARY METASTASES

	Massachusetts General Hospital 1931-1933 Correct per cent	Huntington Memorial Hospital 1931-1936 Correct per cent
Pre-operative diagnosis		
Positive	68	91
Negative	79	61
Average, per cent	74	76

of the likelihood of the presence of involved glands It is not doubted that an axillary dissection can be performed by a good surgeon without removal of the muscles, but is it as good a dissection, and can it ever be as complete a dissection as can be done by the same man when the muscles are removed?

The second piece of evidence against leaving the muscles is found in the occasional patient who suffers a local recurrence in the muscles and not in the glands following complete simple mastectomy for "early" carcinoma Two such patients have been seen at the Pondville Hospital this year (10) Further evidence is seen in the important studies made by the late Dr Wainwright (13), who before his recent death contributed so much to the study of cancer and its spread It may be held that the radical operation is too dangerous This should not be true In properly selected cases the operative mortality should be in the neighborhood of 2 per cent or less, as has been reported for many years in the Harvard Cancer Commission publications (3, 4, 5, 6, 8, 9), and from many other clinics For all these reasons we disagree with Graham in advising non-radical operations upon even the few patients with proved cancer of the breast for whom he advised them We do not believe it is possible to pick out the few patients for

TABLE III—CANCER OF THE BREAST

Comparative Results by Years (9)

Period	Cures per cent	Duration of cures years
1894-1904	19	3
1905-1914	27	5
1915-1920	30	5
1921-1923	35	5
1924-1926	41	5
1927-19 9	43	5

whom we admit this procedure would be safe

In the case of individuals sent to the hospital for postoperative x ray treatment within 1 month following a simple mastectomy, no x ray treatment is given but a radical operation is done. In half of these patients definitely involved nodes are found. Where would they be without having had a removal of the nodes? Some surgeons also claim that there is disability from the loss of the muscles. That has never been seen in the many patients upon whom operation was performed at the hospital.

SELECTION OF PATIENTS FOR RADICAL OPERATION

A most important part of Graham's paper shows frankly how many radical operations were performed in a futile attempt to cure the incurable. We agree completely with him that such patients should never have radical procedures and should seldom undergo any surgery beyond a biopsy. A patient who complains of a breast tumor has the following course of study at the Huntington Memorial Hospital.

After a preliminary history has been taken, a careful local examination is made. If the following conditions are found the case is considered to be inoperable: A fixed mass, fixed axillary nodes, any involved supraclavicular nodes, wide skin involvement, subcutaneous nodules, edema of the breast and edema of the arm. It is to be noted that a large tumor, locally fixed to the skin or not, and locally ulcerated or not does not in itself make the situation inoperable. In addition, movable axillary metastases do not do so. After this examination is completed all patients in whom there is a positive or likely diagnosis of cancer are subjected to the following x ray examinations: chest, lateral view of the thoracic and cervical spine, anteroposterior view of the

lumbar spine and pelvis, lateral view of the skull. If metastases are found in any of these plates the case is also considered to be inoperable. If no metastases are found an estimate is made of the patient's general condition, and particularly of the circulatory system and respiratory tract. Complete physical examination is done and occasionally evidence of intraperitoneal extension is found. Operation, of course, is never performed in such instances. If the patient is in good condition an appointment for radical operation is made and the operation is performed the day after the patient's admission to the hospital. If the patient is a poor risk, he is put to rest in bed, studied medically, and treated when indicated for a few days in the hospital. By this regimen a patient's general condition can be so improved as to enable him to undergo a radical operation.

In some cases the diagnosis as to the presence of cancer is a borderline one. In these instances the course of study mentioned is carried out and the patient is prepared for radical operation. An incision is made directly over the tumor, which is incised, or removed with a fair margin of tissue. Immediate frozen section diagnosis is made. If this shows cancer the wound is packed with formalized gauze and is carefully sutured, the instruments, gowns, gloves, and drapes are discarded. The skin is newly prepared and the radical operation is proceeded with.

TREATMENT OF THE POSSIBLY CURABLE PATIENT

Under the teaching of the late Dr. Greenough, the Halsted incision has not been used for many years. However, we do not disprove of a properly done Halsted operation. We merely think that in our hands the following operation, which complies in every way with Halsted's objectives, is more easily performed and affords better possibilities for plastic closure when large amounts of skin have to be removed. The transverse axillary or Rodman incision is used. The axilla is dissected first, after the two muscles are divided near their insertions. When this dissection is complete, the breast is removed in one piece with the axillary contents, muscles, and skin. The

skin is removed sufficiently widely so that at times a skin graft is necessary. Recently electrocoagulation rather than tying has been used for all bleeders other than the branches of the axillary vein and artery, but the entire dissection is done with a scalpel or scissors. Coagulation of the bleeders saves much time and results in at least as dry a wound as the former method. An axillary drain is used.

Pre-operative x-ray treatment is not used. Definite proof of its value is not clear to us as yet. We are, however, watching certain work in other institutions with great interest as it is possible that a valuable method of giving this treatment may be worked out shortly. Prophylactic postoperative x-ray treatment is given over the operative site to only a few patients with a highly malignant cancer. However, all women who have not passed the menopause are sterilized by x-ray (11).

TREATMENT OF THE INCURABLE PATIENT

This group is made up of patients with extensive disease as outlined, rarely of patients with operable local lesions who cannot by any preparation be put into proper condition for the operation, and patients with recurrences following radical surgery. These patients are all given high voltage x-ray treatment to the local lesion and all known metastases. Quite large doses of x-ray are given and if the patients are from out of town they remain in the hospital during the course of treatment. Radium is used practically not at all. The lack of useful palliation or cure by inserted platinum needles (Keynes) containing radium has been reported by McKittrick (7). Taylor (12) has already reported the results of such treatment at the Pondville Hospital and elsewhere. Very few non-radical operations are done on a palliative basis, as has been recommended frequently in the past and is being done rather extensively at present in other institutions. X-ray treatment has been found to be followed by healing of the local lesion which is kept in check during the time the patient remains alive. Although, as stated above, we pay little attention to either pre-operative or postoperative x-ray treatment we think palliative treatment by this means for the patient who is not a good operative risk or

for the patient with recurrence after complete operation is of the greatest value. Within the last 2 months the first treatments on a new one and one-half million volt machine of radically new design have been started. These are still purely experimental and we are not as yet prepared to give a report on the immediate results of this treatment.

RESULTS OF CURATIVE OPERATIONS

The Huntington Memorial Hospital during its existence has been an experimental institute. It has very few beds for house patients and these beds have been used primarily for patients receiving various kinds of radiation treatment, experimental or otherwise. Patients in need of standard surgical procedures have been transferred to other hospitals. In most cases they were transferred to the Massachusetts General Hospital. One of the largest series of papers dealing with thoroughly followed operations and uniformly presented cases is that of Greenough and his co-workers, already mentioned. Table III, which I am including in this paper, appears in the final paper of Greenough's series, and presents what is accomplished by following the principles herein stated.

Before going back to the original papers any younger surgeon might think that the reason the results improved so much between the first and second interval was because the radical operation was less frequently done in the first period. As a matter of fact, this is not true. Dr. J. Collins Warren, who was the founder of the Huntington Memorial Hospital, was a leading surgeon at the Massachusetts General Hospital then, was greatly interested in radical cancer surgery, and he and his colleagues all adopted Halsted's principles in 1894 when they were first published. The percentage of radical operations was as high in the first series as in any subsequent one. We must therefore look elsewhere for these improved results. Although the operative mortality was slightly higher in the early period it was not enough so to make this difference.

The whole difference may be accounted for by a stricter choice of patients to whom the chance of operative cure was offered. This was

accomplished in two ways. First, by assigning such patients to a few individuals instead of having them spread among the whole staff. This accounts for most of the improvement between the first and the second series. This improvement was really greater than the difference between 19 and 27 per cent because in any series studied at a 3 year interval there will be a considerable further loss by the time 5 years have passed.

During the years of the third and fourth series x ray study, first of the chest and later of the bones, began to be used to eliminate some cases previously considered to be operable. By the time of the last paper this had become absolutely routine. All the improvement in results of treatment shown in this series of papers can be attributed to three factors: (1) better choice of cases, (2) concentration in the hands of experts, (3) larger proportions of early cases.

SUMMARY AND CONCLUSIONS

1. Patients with suspected cancer of the breast should be very carefully studied before the course of treatment is decided upon. This study includes complete history, physical examination and x ray examination of the chest, spine, pelvis and skull.

2. Following this study the patients should be separated into two classes: (1) those with a chance of cure; (2) those without a chance of cure.

3. The former should undergo radical procedures without previous radiation treatment. Postoperative x ray treatment is not a necessary part of the routine for all patients.

4. The patients classed as incurable should be given powerful doses of x ray, and no surgery and usually no radium.

5. Patients with recurrence following radical operation should have palliative treatment by x ray and, occasionally, by radium.

6. When patients are treated in this way 43 per cent of those operated upon should remain "cured" for 5 years. Of these, 75 per cent of the patients without positive nodes on pathological examination and 25 per cent of those with positive nodes are "cured."

REFERENCES

1. GRACE E. J. Simple mastectomy in cancer of the breast. *Am J Surg* 1937 35 512-514.
2. GRAHAM ALLEN. Cancer of the breast. *Surg, Gynec. & Obst* 1937 64 609-616.
3. GREENOUGH R. B. Carcinoma of the breast: results of treatment 1918 1919 1920. *Am J Roentgenol* 1926 16 439.
4. GREENOUGH R. B. and SIMMONS C. C. End results in cancer cases of the breast. *Boston M & S J* 1921 185 253.
5. GREENOUGH R. B. SIMMONS C. C. and BARNEY J. D. The result of operations for cancer of the breast at the Massachusetts General Hospital from 1894-1904. *Surg, Gynec. & Obst* 1907 5 39.
6. GREENOUGH R. B. and TAYLOR G. W. Cancer of the breast: end results. *Massachusetts General Hospital 1921 1922 1923. New England J Med* 1934 210 831.
7. MCKITTRICK L. S. Interstitial radiation of cancer of the breast. *Ann Surg* 1937 106 631-644.
8. SIMMONS C. C. TAYLOR G. W. and ADAMS H. D. Cancer of the breast: end results. *Massachusetts General Hospital 1927 1928 1929. New England J Med* 1936 215 521-525.
9. SIMMONS C. C. TAYLOR G. W. and WALLACE R. H. Cancer of the breast: end results. *Massachusetts General Hospital 1924 1925 1926. New England J Med* 1934 210 836.
10. TAYLOR G. W. Personal communication.
11. Idem. The value of artificial menopause in carcinoma of the breast. *New England J Med* 1935 213 1202.
12. Idem. Radium dosage and technique in carcinoma of the breast. *Am J Roentgenol* 1935 32 103-134.
13. WAINWRIGHT J. M. Certain principles of breast surgery illustrated by sections showing approximately the entire breast. *Atlantic M J* 1928 31 625-629.

FIVE YEAR END-RESULTS IN THE TREATMENT OF CANCER OF THE TONGUE, LIP, AND CHEEK

HAYES E. MARTIN, M.D., F.A.C.S., New York, New York

IT IS axiomatic that the efficacy of a therapeutic procedure must be determined not by the number, but rather by the percentage of cures obtained by its use. Obviously, the end results or the percentage of permanent cures in diseases such as cancer may not be calculated except after an extended period of observation so as to preclude the probability of late recurrence. However, another factor must be taken into account in all calculations of end-results, namely, the make-up of the group of patients upon whom the calculations are made. Unless the clinical material is of uniform average quality, as regards the stage of advancement in patients with cancer, comparative end-results are meaningless. This applies particularly to the practice of selecting only those patients who are "operable," "early" or otherwise favorable.

To be truly representative, a group of cases upon which end-results are reported should consist of a consecutive series of all patients in any and all stages of the disease, whether primary or recurrent, as they present themselves for treatment. Such a concept is, of course, not new, but it is honored more often in precept than in practice. The only permissible deductions from the total are those cases in which the eventual results of the treatment for cancer cannot be determined by reason of death from unrelated causes, and those in which patients are lost track of without recurrence after a reasonable period of freedom from disease (1 year). It will be conceded that neither of these modifying factors is capable of control by the physician nor can they be influenced by the efficacy of the treatment. These factors will be discussed more fully later.

The end results reported in this communication were calculated on the basis of the foregoing standards and represent a sincere effort to record the actual statistical data as regards

Presented before the Fifth International Congress of Radiology,
Chicago III, September 1937.
From the Head and Neck Service, Memorial Hospital.

the possibility of cure and the prognosis in certain anatomic forms of cancer in our clinic.

THE LENGTH OF THE POST-TREATMENT OBSERVATION PERIOD

A 5 year period of freedom from recurrence is at the present time generally accepted as a reasonable basis for computing the percentage of permanent control in cancer. The selection of a 5 year period for all varieties of cancer is somewhat arbitrary, since it is well known that the possibility of late or remote recurrence differs considerably in the various anatomical and histological forms of the disease. For instance, it is common knowledge that cancer of the lip or mucosa of the cheek rarely recurs after even 3 years, while in other varieties, such as anaplastic cancer of the pharynx, cancer of the breast, and melanoma of the skin, disseminated metastases may develop 10, 15, 20 years, or even longer after control of the primary lesion.

One must concede, therefore, that strictly speaking, absolute cure of cancer is not assured until the patient has survived for a period longer than that of any recorded instance of recurrence in his particular anatomical and histological variety of the disease. However, statistics based on such long periods of survival would be of little or no practical value in evaluating the comparative merits of several methods of treatment. By the time 20 year, 15 year, or even 10 year cure rates had been determined, the treatment methods employed would necessarily have been considerably modified or superseded, and the series of cases upon which the calculations were based would be greatly reduced by deaths from other causes. Under such severe standards, we should be deprived of the opportunity of modifying and improving our methods on the basis of the experience and results of our contemporaries. During such a long period, the individual investigator himself might

have passed from activity into retirement. A comparison of the methods in use 15 or 20 years ago would be of greater historic interest than practical value. Therefore, it seems likely that considered opinion will settle upon the standard of a 5 year cure¹ as a logical compromise between absolute fact and average probability.

THE LENGTH OF THE PERIOD COVERED IN SINGLE REPORTS

Since it is inevitable and proper that the treatment methods in any disease should evolve and progress, statistical reports on groups of cases ranging over periods of 10 to 20 years can be of little practical interest, except in the study of the clinical course of the more rare diseases. Most reports covering such long intervals serve mainly to emphasize the personal achievements of a single individual or of one institution, and as such, have a historic rather than a practical significance.

A report of end results is of little more than academic interest unless the patients upon whom the statistics are computed were all treated within a definite, limited time period, preferably short, so as to cover no more than a 5 to 10 year interval. To be of timely interest, the end report had best be made immediately following the completion of a 5 year observation for the whole group, as for instance, a series of patients treated during the several years immediately preceding 1930 should be reported in 1935, etc.

The grouping of cases treated over longer periods in one report suggests a static rather than a progressive attitude toward the cancer problem. For these reasons, it has been made the policy in our clinic to limit statistical reports to groups of cases in which patients were treated over shorter periods (about 5 years) so that in the future, one may have a standard with which to compare the actual value of any subsequent development or improvement in technique.

¹The general acceptance of a 5 year period as being necessary for cure is comparatively recent. Until well past the middle of the nineteenth century the cancer patient was commonly spoken of as "cured" if he survived the surgical operation, although even at that time recurrences had been recorded as late as 35 years after operation. Butlin, in the first edition of his *Disease of the Throat* (1888) calls attention to the inadequacy of the less than a year's freedom from disease for cure in cancer of the tongue while in his second edition (1901) he speaks of a 5 year period as being generally accepted. Up until the second decade of the twentieth century a 5 year period was considered ample and even today, one finds numerous reports of 5 year cures in the literature.

COLLECTED AND SELECTED CLINICAL MATERIAL

To be fully informative, a series of cases used for statistical purposes should be unselected—that is, it should be made up of all patients in any and all stages of the disease who have been observed within a specified period. The cases must therefore be consecutive and collected, rather than scattered and selected. The selection of cases on the basis of operability or probable curability renders a report of the end-results of limited value, since there can be no uniformity of individual opinion as to what constitutes operability or curability, and it is obviously difficult, if not impossible, to avoid a personal bias in choosing mainly those cases which will favor the operator. One must admit that an astute and experienced surgeon could deliberately select a group of patients even with as lethal a disease as cancer of the tongue in whom he could obtain an almost perfect percentage of cures.

The aphorism "The physician sometimes cures, often relieves, and always consoles" finds no greater field of application than in cancer. It is of little interest or benefit to the patient already suffering from cancer to be informed that early or operable or otherwise favorable cases of his disease may be cured in a high percentage of instances. What he wishes to know is whether or not *his case* may be cured or benefited, and what methods of treatment offer him the most likely relief.

In the head and neck clinic at Memorial Hospital, all ambulatory cases of intra oral cancer, both primary and recurrent, are accepted for treatment or palliation, and are attended as long as they are able to travel to and from the clinic. No patient is refused admission to the clinic because of the advanced stage of the disease. In some instances, patients apply at the clinic in the early stages of the disease, but are unable because of some unrelated form of physical disability or because they live at too great a distance from the clinic to return as often as would be necessary for adequate treatment. Such patients must be refused as being unacceptable for admission. Few are excluded for these reasons; however, since most patients with intra oral cancer remain ambulatory almost to the end

TABLE I—MEMORIAL HOSPITAL HEAD AND NECK SERVICE 5 YEAR END RESULTS IN INTRA ORAL CANCER

	All cases of cancer of the tongue 1922-1931 inclusive	All cases of cancer of the lip 1928-1931 inclusive	All cases of cancer of the cheek 1925-1929 inclusive
Total number of cases	322	251	99
Indeterminate group			
Dead as a result of other causes and without recurrence	27	20	5
Lost track of without recurrence	5	34*	3
Total number of indeterminate results	32	63	8
Determinate group			
Total number minus those of indeterminate group	290	188	91
Failures			
Dead as a result of cancer	215	58	59
Lost track of with disease (probably dead)	0	0	3
Living with recurrence	1	0	1
Total number of failures in treatment	216	58	63
Successful results (Free from disease after 5 years or more)	74	130	28
Five year end results (Successful results/Total Determinate group)	25% (74/290)	69% (130/188)	30% (28/91)

*Further follow up is being carried out and the percentage of 5 year cures (69%) will undoubtedly be raised

These groups consist of all proved cases of cancer of the tongue lip and cheek, both early and advanced in which patients were admitted during the specified periods (Only those patients are excluded who made no more than one or two visits and who were then lost track of within the first month)

The groups of cases presented in this report are made up of all comers and are consecutive and collected rather than scattered and selected. For these reasons, this report should represent the actual results which may be obtained in a true cross-section of intra-oral cancer, as it exists today in a large metropolitan center.

THE INFLUENCE OF UNCONTROLLABLE FACTORS ON THE APPARENT CURE RATE

If one could exclude every other modifying influence except cancer for a full 5 year period, the percentage of cures should properly be calculated on the total of all cases without any subtractions. But as will be shown, there are several factors influencing the apparent percentage of cures which are beyond the control of the surgeon, and which are not affected by the efficacy of his treatment. These uncontrollable factors are, first, deaths from other causes unrelated to cancer, second, the inability to trace certain apparently cured patients for the full 5 year period (these two make up the indeterminate group), and third, failure of the patient to accept the proffered treatment. None of these minority groups can be fairly counted either for or against the percentage of cures. Each of these factors will be discussed separately.

1 *The indeterminate group* consists of patients dead from unrelated causes and those without recurrence who are untraced for the full 5 year period. If following clinical disappearance of the cancer and without recurrence, the patient dies within the 5 year period of unrelated causes (heart disease, old age, accident, etc.) not incident to, or as a complication of, treatment, the case may not be fairly counted as either a cure or a failure. Those lost track of after 1 year without recurrence are also indeterminate, and not fairly counted either for or against the percentage of cures. Both of these groups may fairly be subtracted from the total before the net percentage of cures is calculated. To count either of these groups as failures to cure is, in my opinion, an ostentatious gesture toward a precision which serves only to obscure the more important facts relating to the efficacy of treatment.

2 *Failure to complete the treatment once begun* is frequently due to some defect in the method itself which makes it unacceptable or intolerable to the patient. In such instances, the failure to manage the patient may be the fault of the surgeon or the method of treatment, and as such, should be counted against the percentage of cures. It is reasonable, however, that one should exclude those patients

TABLE II—FACTORS INFLUENCING THE PROGNOSIS IN 322 CASES OF CANCER OF THE TONGUE OBSERVED AT THE MEMORIAL HOSPITAL 1927-1931

	Total number of cases	Number of 5 year cures	Per cent of 5 year cures
Age in years			
Below 40	23	9	39
41 to 50	48	16	33
51 to 60	120	26	21
Over 60	131	23	16
Sex			
Males	276	48	18
Females	46	16	35
State of disease			
Operable	90	50	55
Borderline	42	18	42
Inoperable	190	10	5
Position of growth			
Anterior third	42	13	31
Middle third	180	51	28
Posterior third	95	8	8
Metastases			
None at any time	125	51	40
Present on admission	113	6	5
Developed after admission	84	19	22
Histopathology			
Epidermoid carcinoma Grade I	51	23	45
Epidermoid carcinoma Grade II	177	35	25
Epidermoid carcinoma Grade III	23	1	4
Lympho-epithelioma	2	0	0
Transitional cell carcinoma	14	2	14
Adenocarcinoma	5	0	0
Not classified	50	13	26
Associated leucoplakia	69	26	37
Associated syphilis	70	14	20

*Biopsy positive but unsatisfactory for exact classification

who belong to the well known class of "clinic shoppers" and who go from clinic to clinic, sometimes trying out a treatment or two in each. Such individuals characteristically make only one or two visits and then disappear. There have been excluded from these series for this reason those who were lost track of during the first month after making no more than two or three visits to the clinic.

NET 5 YEAR END RESULTS IN CANCER OF THE TONGUE, LIP, AND CHEEK

Using these standards for the determination of groups of cases upon which to calculate statistics, there is presented in Table I the 5 year end results in the main anatomical varieties of intra oral cancer at the Memorial Hospital. Our treatment methods in all of these diseases either have been or are soon to be published elsewhere (1, 2, 3).

In the choice of treatment methods, we

are not influenced by any attempt to prove the superiority of either radiation or surgery. Our staff is composed entirely of surgeons who select, prescribe, and administer radium, x-ray, or surgery, either alone or in various combinations of two or all three in the individual case, depending on the particular advantages and limitations of each agent. The particular form of treatment for the individual case is selected first on the basis of its probable success in obtaining a permanent cure with reasonable comfort. Secondary considerations of importance are the functional and cosmetic result, the length of the convalescent period and the expediency of the proposed plan.

As the surgeon becomes more proficient in the use of radiation, either alone or in combination with surgery, the term "inoperability" becomes less and less synonymous with "incurability," and on the other hand, "radio resistance" does not necessarily preclude an excellent prognosis by surgery.

I believe that some uniform method of reporting end results in cancer should be adopted officially by some influential national surgical organization or publication. If so recognized, its general adoption would soon follow. It is not sufficient to settle upon a uniform observation period, such as the generally accepted 5 year interval. If no uniform method of collection or selection of cases is established the percentage of 5 year cures may be calculated on any one of such arbitrarily chosen portions of the whole group that the statistician may obtain a wide selection of 5 year cure percentages. A reference to Table II which is an analysis of the same series of lingual cases cited in Table I, will reveal that by selecting only the "operable" group (a not uncommon procedure in reporting end results), one could claim a 5 year cure rate of 55 per cent in cancer of the tongue, which is more than double the correct figure (26 per cent) for the whole group as shown in Table I. By selecting only those without metastases, a 40 per cent cure rate is obtained. It would be no more illogical to select only the age group under 40—39 per cent—or only the females—35 per cent—than to calculate end result percentages on the operable group alone.

Even a cursory survey of the present day

medical literature will reveal reports based on cases selected because of "operability," "absence of metastases," "primary lesion less than two centimeters in diameter," etc. These highly selective groups are commonly chosen by both the partisan surgeon and the partisan radiologist to emphasize the advantages of his particular method of treatment. While he may be perfectly correct in his attitude toward one particular subgroup, a broader view demands a consideration of all cases in any and all stages of the disease. Viewed with this broader concept, such subclassifications as "operability" and "presence of metastases" assume an equal significance with "age," "sex," "histological form," etc. In other words, all subdivisions or subgroupings become "factors influencing the prognosis." Strictly speaking, no figure so calculated may be interpreted as an "end-result."

The form set down in Table I is submitted as a reasonable method of calculating 5 year end results in cancer. It could just as fairly be used to express the end results in measles or appendicitis. The table begins with the designation of the total number of cases seen during a specified time, and specifies that none were excluded on the basis of the advanced stage of the disease. Next follows an enumeration of the "Indeterminate group," which consists of those dead of other causes without recurrence after 1 year and those lost track of without disease after 1 year. This indeterminate group is subtracted from the total, leaving a net or "determinate group" upon which the end-results may be calculated. Next come the "failures in treatment," which include first those dead of cancer, those lost track of with disease (including those who did not complete the treatment), and those who are living after 5 years with recurrence. The difference between the determinate group and the failures is made up by those cases in which patients are living and well after observation for 5 years or more. The net end-results are then calculated by the percentage expressed by the equation—living and free of disease after 5 years (/) determinate group. If the surgeon wishes to record the cure rates in the various selected subgroups of the total, those data should be set down in a prognosis table,

as is shown in Table II. The extent of such an analysis may vary, depending upon the information available and upon the probable significance of the factors influencing the prognosis in the specific anatomic form of cancer under consideration. While such data are of great significance and importance in the study of the clinical behavior and of the treatment methods in cancer, they cannot properly be considered as end-results.

SUMMARY AND CONCLUSIONS

From published statistical data, it is often difficult or impossible to evaluate properly the comparative merits of contemporary treatment methods in cancer because of the wide differences in the make-up of the clinical material upon which the reports of cure rate statistics are calculated. The most misleading forms of reports are those based upon the arbitrary selection of early, "operable" (those operated upon) or otherwise favorable cases, rather than upon all comers in all stages of the disease, both the early and favorable, and those hopelessly advanced. Other difficulties are the lack of uniformity in the length of the post-treatment observation interval in various reports, the scattered rather than the consecutive character of the clinical material, and the inclusion in single reports of cases in which patients were treated over too long periods, during which period the treatment methods may have undergone marked changes.

There is a need for a uniform tabular method for reporting of end-results which would overcome these inconsistencies. Such a method should largely prevent the arbitrary selection of clinical material and still permit certain corrections for uncontrollable factors. Based upon these principals, a method or form is suggested with a report of the net percentages of 5 year end results in cancer of the tongue, lip, and cheek at Memorial Hospital.

REFERENCES

- MARTIN, H. E. Treatment of cancer of the lip. *Am J Surg*, 1935, 30: 215-226.
- MARTIN, H. E., and MUNSTER, H. Cancer of the tongue. Study of 322 cases with results of treatment at the end of five years. To be published.
- MARTIN, H. E., and PFLEGER, O. H. Cancer of the cheek (buccal mucosa). Study of ninety nine cases with results of treatment at the end of five years. *Arch Surg*, 1935, 30: 731-747.

ILEOCECAL LYMPHADENITIS IN CHILDREN

ARTHUR E. BROWN M.B., B.Ch., F.R.C.S., Colac Victoria, Australia

IT IS now generally recognized that there exists in children and young adolescents, an acute abdominal condition, in which the symptoms are very similar to those of appendicitis, but in which the predominant findings at operation, and presumably the principal pathological basis, consist only of an inflammatory enlargement of the mesenteric and retroperitoneal lymph glands draining from the ileocecal angle. The condition is common and owing to its resemblance to appendicitis most cases come under the direct observation of surgeons. Nearly always the pre-operative diagnosis made is appendicitis. Admitting that the clinical picture seen in the two conditions is very similar, my own experience with cases of ileocecal adenitis teaches me that with care and a knowledge of the condition a correct pre-operative diagnosis is possible in at least a reasonable proportion of cases.

The general picture of such a case is as follows. The patient is between the ages of 3 and 18 years. He is seized with abdominal pain which is of varying severity and can generally be traced to the right lower abdomen. During the attack there is evidence of definite toxicity. The attacks subside as a rule, and the child has intervals of weeks or months during which he is apparently perfectly well, but the attacks recur and will continue to recur, until the operation of appendicectomy is performed, after which he will be free from symptoms. In English the standard and probably best known descriptions of the condition are those of Fraser in his book *The Surgery of Childhood*, and of Braithwaite in the *British Journal of Surgery* of 1925.

Fraser writes of it, "There is considerable general disturbance and fever. The symptoms rarely last for more than 24 to 48 hours and abate with characteristic suddenness. The pain is local from the start, never referred. The tongue remains clean." And he emphasizes a little later, "The attack subsides with characteristic rapidity."

Braithwaite divides the cases for the purposes of description into three age groups. In children from 2 to 6 years old, his description closely agrees with that of Fraser. Of the symptoms in children aged from 6 to 10 years he says "They are typified by acute attacks of sudden abdominal pain suggestive of intestinal colic. With the onset of the pain the child cries out, holds its belly with both hands, draws up its legs, and in 10 minutes is perfectly fit and well. Occasionally there is vomiting, more rarely there is a passing rise of temperature to 100 degrees F. The child though appearing in pain during the attack is perfectly well after it and before it. There may be two or three attacks during the day, or there may be intervals of months between the attacks." He classes children aged from 10 to 16 years in a third group, in which he says ileocecal adenitis does not usually occur.

It will be noticed that there is a very considerable difference between these two descriptions. I propose to set out a small series of cases of my own, in most of which reasonably careful histories and records have been taken. It will be seen that the clinical analysis of them does not bring them into close agreement with either of the two descriptions quoted.

CLASSIFICATION

I am grouping them for convenience into two main groups, of which Group A comprises those of the more acute type, which closely simulate acute appendicitis, and in which one operates urgently expecting to find a grossly and acutely inflamed appendix. Group B comprises those cases in which the general picture is that of a milder or recurrent type of symptom complex, in which the need to operate does not appear so urgent, and in which the operation is usually performed in the expectation of finding a "subsiding" or "chronic" appendicitis. Necessarily the difference between the two groups is one of degree only, and the distinction is not very clear cut. I propose to illustrate each group by set-

ting out a typical case history in full, before proceeding to a full analysis of the general clinical picture

Group A Acute cases This group consists of 7 cases, of which 3 are atypical, in that they are all three members of one family, all attacked within a week of each other, and showed gross edema of the cecal or colonic wall in addition to the glands. These 3 cases must have owed their origin to some common infection of an alimentary nature, and although they must be brought into the group of more acute ileocecal adenitis, I regard them as forming a class apart from the others. The 4 other cases were patients suffering from acute symptoms in whom at operation no major pathological changes were found in organs other than the glands. They closely simulate acute appendicitis, and the patients are generally operated upon under that diagnosis. There is often a palpable mass, and the condition is obviously one of a very acute infection. The following case is typical of the class

CASE 17 Frank A, aged 14 years, male. First symptoms occurred 6 days prior to examination, when he became ill with what his parents described as "influenza." He was feverish for 2 days, immediately after which he had severe abdominal pains with fairly severe retching. The pains persisted, being more or less severe in degree, and were said to be definitely worse after taking food. The day before examination he had an attack of shivering, and that evening the pain became localized in the lower right side of the abdomen. His bowels were described as being "inclined to constipation." During the past 2 years he had had repeated attacks of general abdominal pain, these being less in evidence during the past 12 months. On examination tongue was found to be dry and dirty, the temperature, 102 degrees, pulse, 112, respirations, 20, leucocytosis, 18,000. The abdomen was flat. There was tenderness in the right iliac region, overlying a tender mass felt beneath the abdominal wall. The mass was dull to percussion, and lay higher and rather more internally than the usual position of an appendiceal abscess. The urine showed a cloud of albumin. A diagnosis was made of ileocecal adenitis, and operation was withheld for a period of observation. The blood picture on the succeeding 4 days is shown in the table which follows

On the fourth day the mass felt appeared to be more extensive in an upward direction, and his temperature was 103.2 degrees. Operation was then performed. The appendix was normal in appearance, though with a slight degree of congestion in the

Date	Leu- co- cytes	Meta- mye- locytes	Poly- mor- pho- nu- clears	(% band forms)	Eo- sino- phils	Baso- phils	Lym- pho- cytes	Monoc- ytes
October 20	18000		73	44	0.5		22.5	3.5
October 21	14200	0.5	37.5	35	1.5		37.5	1
October 22	9000	1.5	64	35	2	0.5	26	6
October 23	11000		66.3	48	2		23.3	5.3

serosa. It was neither inflamed nor edematous. There was a large mass of retroperitoneal glands acutely inflamed, the largest and reddest being in the ileocecal angle, smaller and less inflamed along the common iliac vessels and toward the root of the mesentery becoming smaller as they went centrally. The temperature became normal within 24 hours of the operation and remained so. The albumin disappeared from the urine, and 6 days after the operation the blood picture was

Leucocytes	12800
Metamyelocytes	
Poly morphonuclears	57.5
(% band forms)	13.5
Eosinophils	4.5
Basophils	
Lymphocytes	33
Monocytes	5

His health has been uniformly good since the operation, with no attacks of pain

Group B Subacute or recurrent cases These are much the more common type, and 23 of the 30 cases discussed belong to this group. The difference is one of degree only, and individual cases of one group may verge on the characteristics of the other, but on the whole the clinical distinction between the two is sufficiently real to justify the division. The following case may be presented as being characteristic

CASE 21 George P, aged 13 years, male. First symptom appeared 2 days before examination. The boy had an attack of pain in the abdomen in the afternoon while going to work. He did not vomit, but felt sick. He had his evening meal, and slept well all that night. Pain was still present next morning, and he stayed away from school, but had all his meals. There was an interval at mid day free from pains, but they recurred in the afternoon. He slept all night, but found the pains still present on waking the following morning. The bowels were open normally throughout. The pain was always located below and to the right of the navel. In the previous 6 months there had been three attacks of pain similar in nature, and lasting from half a day to a day. On examination, the tongue was found

to be dirty, the temperature was 99.6 degrees pulse 112, respiration rate, 20. The urine showed no abnormalities. Blood examination showed a leucocyte count of 20,800, the differential count being polymorphonuclear leucocytes 44.5 per cent and mature in type eosinophils 6.5 lymphocytes, 46 monocytes, 3 per cent. The abdomen was tender just below and to the right of the umbilicus not at McBurney's point. There was no rigidity but a feeling of slight mass under the pressure of the fingers. A diagnosis of ileocecal adenitis was made, and operation fixed for the following day. On the next morning the blood count was repeated, and showed a strikingly different picture. The total leucocyte count was 29,600 with 86 per cent polymorphonuclear cells, well matured, and only 10.5 per cent lymphocytes. The eosinophils had disappeared altogether. At the operation the appendix was found to be large and bulky, with some congestion in its appearance but neither edematous nor inflamed. The retrocecal glands of the ileocecal angle, those of the meso appendix and those in the mesentery of the terminal 6 inches of the ileum were enlarged and hard but quite discrete. The temperature fell to normal immediately following the operation and remained at a normal level through out a normal convalescence. He has had no recurrence of his intermittent pains since his operation.

FREQUENCY

The cases are all from my own practice in a country district. The period covered by the series is 13 years, from 1922 to 1935, and during that time there have been 159 cases of young people under the age of 19 operated on for symptoms in the lower right side of the abdomen, suggestive of appendiceal trouble. Of these, 30 or 18.9 per cent, of the patients have been proved by operation to have been suffering from acute or subacute ileocecal adenitis.

Of the 159 patients operated upon, 79 had symptoms indicative of an acute and menacing inflammatory condition, and of these, 72 were found at operation to have an acute and grossly inflamed appendix, while 7, or 9 per cent, were suffering from acute inflammatory swelling of the glands.

Patients with mild and recurrent symptoms numbered 80, of whom 57 included all appendiceal cases other than the acute ones, comprising "mildly inflamed," "links," "adhesions," interval cases, and so forth. Twenty-three of these patients revealed swollen ileocecal glands as the principal pathological finding.

TABLE I—AGE AND SEX INCIDENCE OF ADENITIS COMPARATIVELY TO APPENDICITIS

Age period	Acute appendicitis			Other appendicitis			Ileocecal adenitis		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
1-3	1		1						
4-5	4	2	6	1	1	2	2	1	3
6-8	3	2	5		1	1	3	4	7
9-11	2	6	8	1	2	3	5	1	6
12-14	14	8	22	4	16	20	5	1	6
15-19	14	16	30	8	23	31	4	4	8
	38	34	72	14	43	57	20	11	30

SEX

The sex incidence in these recurrent cases of adenitis is strikingly different from that of "chronic appendicitis." Among the latter in my series, 14 were in males and 43 in females, while of the adenitis cases 13 occurred in boys, and 10 in girls. The figures are too small to mean much, but such as they are they do help to emphasize the existence of adenitis as a separate entity. The incidence of right iliac pains in adolescent girls, for which at operation it is difficult to assign a reasonable cause, is notorious. If boys alone are taken in this respect, the occurrence of adenitis as compared with that of chronic appendicitis is apparently equal, 13 to 14, while in girls the similar comparison shows 10 adenitis to 43 "chronic appendicitis."

CLINICAL CHARACTERISTICS

Age. The youngest child operated upon was 2½ years old, the oldest 19. Another girl was 19 when operated on, but she had had repeated attacks since the age of 12. In general the age of these patients at the time at which they come under the observation of the surgeon may be anywhere from 3 to 18. Table I shows the age incidence in successive three year periods.

Previous history. Fifteen of the 30 cases gave a definite history of previous attacks, going back as far as 7 years in 1 case, 4 years in 2, 3 years and 2 years in others. All the attacks were described as being similar to the one for which operation was eventually performed. In all of them the health of the child

dren between the attacks was stated to be absolutely normal. The intervals were from a week up to 12 months in various cases, and the frequency of the attacks varied greatly in any one case. Two other cases reported almost constant but remittent pains in the abdomen for 5 or 6 weeks before being seen. The 13 remaining, including 5 of the 7 acute cases, were operated upon during or following their first attack.

Duration of attacks The acute group of cases showed no sign of remission of their symptoms up to the time of operation. The longest time between the onset of symptoms and the performance of the operation was 11 days, the shortest 2 days. In the recurrent cases, the duration of the attacks was in some instances determined by actual observation, but for the most part had to be ascertained from the child's mother. There is a wide variation in the duration, from 10 minutes as in Case 15, to 2 days in many cases. As a rule the duration of the attacks may be taken as being 1 or 2 days, and gradual subsidence was the rule.

Accompanying bowel disorders Of the 26 cases in which the condition of the bowels has been recorded, 22 are said to have been regular and normal up to and during the attack. Two were said to be inclined to constipation generally. One had an attack of diarrhea on the fifth day after the onset of pain, but normal evacuations until then. And one passed a "green slimy motion" on the morning of onset.

Vomiting The occurrence of vomiting is noted in 8 cases only, in 3 being severe with constant retching, and in the 5 others a single vomit only. In 17 cases it did not occur, and in 5 the record fails to report on it.

Toxemia In all those 4 acute cases which followed the typical adenitis course and did not show gross bowel wall changes, general toxic symptoms precedent to the onset of pain were very marked. In one case it was described as "influenza," in another tonsillitis, in a third "drowsy and feverish" while the fourth spoke of "feeling sick" for some time before he felt any pain. The child who considered he had tonsillitis, said he had had it for 5 days before pain.

Of the 23 recurrent cases, 8 gave a definite history of precedent symptoms of general toxemia, varying in description from dizziness to headache and delirium. Four showed evidences of general toxicity during the attack, 1 being jaundiced, and 1 having albuminuria. Two had only very mild evidence of toxemia, and in 9 it was either absent, or not recorded.

Location of pain The statement that pain in adenitis is "always local, never referred" is not borne out in any sense in my experience. In 11 of these patients there was a later localization of the pain following earlier generalized pains which were impartially general, upper abdominal, or left sided in position. Four reported general colic-like pains without any later localization. In 7 the pain commenced in the right lower abdominal quadrant, and remained there throughout. In 2 the pain remained referred to the upper abdomen all through the attack, and in 2 it remained localized around the umbilicus. In 4 cases the exact localization of the pain was not recorded.

Location of tenderness In this respect unfortunately my earlier notes are not as exact as they should have been. Too many of them report the tenderness roughly as "right lower abdomen" or "appendiceal region." Eleven cases are noted as having the point of maximum tenderness in the right iliac region, and two as "at McBurney's point," which latter term, in the loose sense in which it is used is probably about equal to "right iliac" in definiteness. In 2 cases the maximum point of tenderness was not specified. Thirteen, however, of the later cases have definite notes recorded, and of these, 3 are marked as "internal to McBurney's point," 1 definitely at McBurney's point, 2 higher than this point, 5 "just below and to right of the umbilicus," and 2 as "just below the umbilicus and both to right and left of it." In 1 case (Case 15), one of the earlier attacks which I personally observed gave a point of maximum tenderness just below and to the left of the umbilicus, while on the next attack, it was just below and to the right of it. Further experience and more careful examination with regard to this in particular, make me feel sure that in nearly all of the 12 first cases, more careful recording

would have demonstrated tenderness at a definite point, differing from that at which the tenderness of appendicitis is usually felt, and that this is a point of decided importance in making a diagnosis

Rigidity In 5 cases rigidity is reported in the right iliac region, and 3 are marked down as doubtful in regard to rigidity. The 22 others had definitely no rigidity of the muscles over the inflamed glands. All those in which rigidity was definitely present were of the acute type, and the absence of rigidity is a point in favor of the diagnosis of adenitis.

Palpable mass The gland masses were palpable through the abdominal wall in only 3 cases, all of the acute type. A mass is not necessarily to be looked for in adenitis, and this is readily understandable when the glands are seen at the operation. It requires a considerable swelling of them, and some conglomeration of the individual glands together, to make them readily palpable without an anesthetic. When it is felt, its position is as a rule higher in the abdomen than is that usually presented by an inflamed mass of appendix and omentum. This point assisted me in arriving at a correct diagnosis in one case.

Tongue In 12 of these cases the tongue was described as 'dirty'. In the others this point was not noticeable. In general the tongue is that of a mild condition.

Temperature and pulse The same may be said of the temperature. In 20 of my cases it was below 100 degrees throughout. In only 4 did it exceed 102 degrees, and only twice did it pass 103 degrees. Evidence of marked intoxication is not shown by the tongue, or by the temperature except in the more acute type of case. The pulse corresponds in nature. Only in 11 cases did the rate rise above 100, and in none of these above 120.

Leucocytosis Examinations of the white blood cells give the same picture of a fairly mild general infection. Counts were made in 14 of my cases, and the results were very largely variable. Thus 1 case showed 20,000 leucocytes on one day, and 29,600 on the next. Another case recorded 16,600 per cubic millimeter one day, and 30,600 the next. In general one expects a count of somewhere

about 20,000, with approximately 70 per cent of neutrophils and these of mature type. In 1 case (Case 17), while the leucocyte and the total neutrophil counts remained steady, there was a persistent increase in the percentage of immature and "band" forms of polymorphonuclears. This has not been common in the less acute type of the disease. Eosinophil counts of 9, 10, and 17 per cent have been noticed, but on one of these being repeated next day, all eosinophils had vanished from the fields counted. The leucocyte count in these cases would seem to be of no value in diagnosis, other than in supplying evidence of a certain degree of toxemia without offering any indication as to the specific cause.

OPERATIVE FINDINGS

Appendix The appendix is never found to show pathological changes comparable to those in the glands that drain from it. The reports on the appendices removed in this series vary from "normal" without comment, to "mildly inflamed" or some other similar term. It is noticeable that the term "long and bulky" occurs rather often in the descriptions, but as these cases are all children, in whom the appendix is usually rather larger relatively than it is in adults, the significance of the description is somewhat doubtful. Reddening of the serosa to a mild degree is seen in about half the cases. The mucosa is most often normal to the naked eye. The contents are mainly semifluid feces, in a few cases stercoliths. Microscopic examination of the appendix wall, which has been carried out in only a few of the cases, discloses only a normal, or slightly congested organ. In an endeavor to support a supposition that the reddening of the appendix seen, represents only a residual inflammatory condition, and that the organ as seen is in a subsiding condition after having been inflamed, and having infected the glands, I divided the cases into those operated on less than 3 days from the onset of symptoms and those of longer duration. I found no support for the theory. Cases of 10, 11, and even 30 days' duration showed the slight reddening in just the same proportion of their total number, as did those seen on the first or second day of the attack. In 1 case in which the

diagnosis had been made and operation had been deferred deliberately until 9 days after the subsidence of the symptoms, the reddening of the lower ileum, cecum, and appendix was as definite as in any I have seen. In no case was there anything remotely approaching an acute inflammation of the appendix.

Lower ileum This was in a few cases described as slightly reddened, along with the appendix. In about half the cases its condition was not specially mentioned, in the rest it is stated to be normal in appearance.

Cecum and colon In 2 acute cases recorded above as of a special type of acute case, and in which the patients were operated on, there was swelling, presumably inflammatory in the cecum and colon. No change in the appearance of these organs is otherwise noted.

Peritoneum Occasionally a small amount of free fluid was noticed in the peritoneal cavity. It was never great, and may on other occasions have escaped my notice. The peritoneum itself seemed to take very little part in the inflammatory process occurring in the glands underlying it. Only in the 2 acute cases mentioned, with swelling in the bowel wall, was edema of the peritoneum or of the meso-appendix noticed. This is in rather striking contrast to the edema of the meso-appendix seen so frequently in cases of acute appendicitis. The peritoneum is usually stretched loosely over the glands, and is not even conspicuously reddened, which fact has probably a bearing on the fact that absence of rigidity of the abdominal wall is such a constant feature of adenitis cases. Apart from the slight reddening sometimes seen in the serous coat of the appendix and lower ileum, the peritoneum appears to take no part in the pathological picture.

Glands In these lay practically the whole of the pathological changes grossly visible. The situation of the glands found to be affected in this series was as follows:

Ileocecal angle and meso appendix	23
Inner border of cecum	5
Along the right common iliac vessels	3
In the root of the mesentery	6
In the mesentery of the lower ileum	7
In the angle between the two common iliac arteries	1

In every case, the glands were large enough to be immediately felt by the exploring finger.

In general when discrete they were about the size of a French bean. In color they were a light tone of liver color, or a reddish pink. Except in those cases in which they had fused into a conglomerate mass, they were readily movable under their peritoneal covering, and on this covering being incised they readily extruded. On section of their capsule the gland substance, pinkish in color, bulged out. Microscopic section of several of them revealed nothing more than a lymphoid concentration of round cells, and cultures of the scrapings taken from two of them *in situ* and cultured on agar, failed to produce any growth.

CLINICAL COURSE OF THE DISEASE

Since the positive diagnosis of adenitis is confirmed only by operation, all reported cases are shown as terminating by operation. It is possible that many other patients suffering from such swelling of the glands have less severe or less frequent attacks, and not being operated upon, never get into the records of adenitis cases. I have among my own records a number of cases of children in whom I have diagnosed adenitis recently and left for further observation. But, the diagnosis not having been proved, they cannot come under discussion here. Country practice, however, affords excellent opportunities for prolonged observation, and I have been able to watch these patients personally for years both before and after their operations. The course of events is apparently this. A child suffers infection of the glands, evidenced by an attack of pain. In many instances this does not lead the mother to seek medical advice, and it subsides, but having once become infected, the attacks of acute swelling have a definite tendency to recur. The child has one attack after another at varying intervals, until the mother takes it for advice. If the condition looks sufficiently like appendicitis the child is operated upon. If as often happens the picture is not completely like that of appendicitis, if the tenderness has passed off, or is placed round the umbilicus, or even to the left of it, operation is deferred. The attacks are still repeated, and finally the child comes to be operated on, and the appendix is removed.

From that time onward the attacks of pain cease, and the child remains in good health. I have watched one such child for 7 years, others for 3 or 4 or less. And I am firmly of opinion that until the appendix is removed, the attacks will inevitably recur. I have not yet seen a child in whom the attacks of pain recurred once the appendix was removed, and I have been able to follow them all closely for years after operation.

What would happen to the glands if the appendix were not removed it is difficult to say. The nature of the disease, and the conditions for making the diagnosis forbid discussion of the point. Whether the glands would become calcified or whether they would gradually lose their susceptibility to the attacks of inflammation with advancing years is problematical. In 1 patient whom I operated on at the age of 19 years, after 7 years' history of symptoms, the glands were—"some hard and calcified, some caseated, some acutely inflamed and edematous." Other patients operated on after 4 years' known history of repeated attacks have shown glands no different from those seen in first attacks.

THE RELATIONSHIP OF THE OBSERVED GLAND CHANGES TO THE SYMPTOMS

The relationship of the gland changes to the symptoms is a matter of some little difficulty to satisfy oneself upon. In one group of cases the patient shows a certain group of symptoms, and when operated upon an evidently diseased appendix is removed—here the relation between cause and effect seems clear. In another group of cases very similar symptoms are exhibited, but operation reveals a cluster of acutely inflamed glands and again the relation between cause and effect seems clear. But there is yet another group of cases with a very similar symptom complex and operation reveals a normal appendix and normal glands, here the assigning of a cause to the effect is not easy. T. A. Smith of New York takes the view that symptoms in this type of case are due to a condition of lymphoid hyperplasia of the appendix, and in the comparatively few cases in which he found glands enlarged he considered them of quite minor importance. My experience leads me to be-

lieve that very careful history taking, and a very close examination of the point of maximum tenderness, will enable a differentiation to be made between those cases in which the appendix is the direct cause of the symptoms and those in which the principal role is played by the glands. And, further, that the inflamed glands are the direct exciting cause of the symptoms. The mechanism of the production of these symptoms is probably this: The toxic symptoms accompanying or preceding the pains, indicate the invasion of the body by the infecting organism, by whatever portal it enters. The largely reflex character of the pains and their colic like nature in the early stages, suggests a reflex bowel spasm due to stimulation of the sympathetics by the development of inflammatory changes probably in the glands or possibly in the ileocecal region of the bowel. And the later localized pain and tenderness are probably due to distention of the capsules of the glands and the immediately surrounding connective tissue. Inflammation of the peritoneum does not appear to play any important part.

PATHOLOGY

By very far the greater part of the discussion on the pathogenesis of inflammatory swellings of the retroperitoneal glands, has hitherto centered round the part which is played in it by the *Bacillus tuberculosis*. Other interesting questions, such as the portal of entry of the infection, and its nature if not tuberculous, have been very much less debated, though they are receiving more attention of recent years than they did in the past. Ten or 20 years ago, the tuberculous basis of the gland swelling was accepted unquestioned. Braithwaite, in his exhaustive article on the subject, quotes 19 authors, of whom 13 used the word tuberculous in the titles of their papers, and the remainder imply a tuberculous etiology in the text, as does Braithwaite himself. Fraser in *The Surgery of Childhood* describes them as tuberculous glands affected by periodical bacterial invasion from the bowel. The constant tendency of the acute attacks to recur once the glands have been infected, certainly inclines one sympathetically toward this theory. The

main objection that can be brought against it, is the difficulty constantly found in proving any tuberculous infection in the glands. Microscopical examination of them by many workers has repeatedly failed to demonstrate in them any tubercle bacilli, or any tuberculous structure. Strombeck analyzed very thoroughly 348 cases of mesenteric adenitis, of which he considered 308 to be tuberculous, and 40 to be non-tuberculous. His tests included many guinea pig inoculations, but his main reliance was in the appearance of calcification appearing in the glands in later life. He considers that calcification should be detectable by x-ray, in 18 months to 2 years after the infection. I have been able to examine by x-ray, 8 of my patients for this purpose. I have not examined any in whom the operation was less than a year previous, since, though the history may go back much further than that time, there was no calcification apparent at the time of operation, and that time is therefore taken as the starting point. The results of these examinations are set out in Table II.

The completely negative nature of the results has, I confess, surprised me. The most surprising point about it is the result in Case 7, in which at operation, 7 years after the onset of symptoms, well marked sharp edged calcified glands were found. The shadow in the roentgenogram is very vague and indefinite, and it is quite evident that the hard calcification of the glands no longer exists. Strombeck, in his paper, discusses the possibility of resorption of calcium deposits in abdominal glands and holds that it does occur to some extent. It has unquestionably occurred almost completely in this case, but the bearing of this phenomenon on the value of this serial examination is not great, for 2 reasons. One is that calcium resorption to any great extent is certainly not usual, and the other is that the varying periods after operation at which the examinations were made and the varying periods after onset of symptoms at which the operations were done should eliminate the possibility that the absence of calcification both at operation and on x-ray, could be due to this cause. The suggestion offered by a study of this series of cases is that there is no

TABLE II — ROENTGENOGRAPHIC RE-EXAMINATION OF CASES

Case No	Time since first symptoms	Time since operation	Result
18	16 mos	16 mos	No calcification
6	9 yrs	9 yrs	No calcification
14	3 yrs 9 mos	1 yrs 9 mos	No calcification
16	5 yrs	4 yrs	No calcification
1	6 yrs	1 yr 9 mos.	No calcification
7	15 yrs	8 yrs	Faint vague shadow ? calcification
8	4 1/2 yrs	4 yrs	No calcification
12	4 yrs	4 yrs	No calcification

proof in them of a tuberculous infection as a basis of the condition. Further than that it is probably not wise to go.

The portal of entry of the infection would seem to be the lower ileum and more particularly the appendix. The distribution of the glands found affected, the occasional finding of reddening of the appendix and lower ileum at operation, and most particularly the complete relief of symptoms achieved by removal of the appendix, make it seem almost self-evident. But certain facts need explaining before it is conclusively proved. The slight degree of involvement of the glands of the meso appendix, in comparison with those in the ileocecal angle and in other places is one of these. Another is the different behavior of the glands in these cases from that in gross acute inflammation of the appendix, in which they are comparatively slightly affected. Influenced by these points, Pribram considers that abdominal adenitis is due to an infection of the body by an organism having a special selective attraction for lymphoid tissue, and regards the tonsils as the main originating focus. He states that he has seen cases in which abdominal pains that have persisted after appendicectomy, have ceased entirely following removal of the tonsils. Nothing I have observed in these adenitis cases inclines me to accept his view, while on the other hand, in one of my cases, the tonsils had been removed a month before the onset of the attack which finally led to operation and cure by appendicectomy. B. Schnitzler explains the peculiar behavior of the glands in these cases on the basis of a delayed infection of

them, the appendix or lower ileum having sustained an infection which has disappeared and left no trace by the time the operation has been performed. As stated, I tried to find some support for this theory by grouping my cases with operation in terms of the duration of symptoms before operation but could find none. It remains the most likely possibility that the condition is caused by an infection with an organism in the ileocecal area, which has a slight local effect, but a marked secondary effect on the glands in the draining area. But the actual pathology and bacteriology of the condition still remain to be worked out almost in their entirety.

SUMMARY

I have presented in this paper a small series of 30 consecutive cases of acute ileocecal adenitis, and have endeavored to show by an analysis of their clinical features that a dif-

ferential diagnosis between this condition and appendicitis is possible, at least in a reasonable proportion of cases. I have drawn from them the conclusion that if operation is not done the attacks of pain will continue to occur intermittently, but that the removal of the appendix will bring about complete and permanent cure. In a short discussion of the pathology of the condition I have not been able to do more than show that tuberculosis as a basis for it must still be regarded as unproved, and to indicate that very little definite knowledge about the actual etiology exists.

REFERENCES

1. FRIEDMAN I. O. La lymphangite péritonéale. *Presse méd.* 1932 40: 1966.
2. SCHNITZLER B. Lymphangitis and adenopathy of the mesentery. *Wien klin Wchnschr.* 1933 56: 137.
3. SMITH T. A. Lymphoid hyperplasia of the appendix in children: its relation to recurrent appendicitis. *Ann Surg.* 1924 79: 871.
4. STROMBECK J. P. Mesenteric lymphadenitis: a clinical study. *Acta chirurg Scand.* 1932 70: suppl. 20.

CLINICAL SURGERY

FROM THE TUMOR CLINIC, MASSACHUSETTS GENERAL HOSPITAL

THE GREENOUGH TECHNIQUE OF RADICAL MASTECTOMY

GRANTLEY W TAYLOR, M D, F A C S, and ERNEST M DALAND, M D, F A C S,
Boston, Massachusetts

THE modern treatment of carcinoma of the breast by radical removal of the breast, both pectoral muscles, and the axillary contents was first carried out and described by Halsted and Willy Meyer. J C Warren, of Boston, promptly adopted the new operation, and published a modification based primarily on Meyer's technique of operation. The late Dr Robert B Greenough was early associated with Warren in this field of interest, and one of his first publications (1) dealt with an end result study on cases of carcinoma of the breast. William L Rodman was also responsive to the teachings of Halsted, Meyer, and Warren, and described a modification of the operative technique employing a transverse axillary incision. Greenough was prompt to recognize the merits of the Rodman operation and adopted it in his practice. He modified Rodman's technique by removing a wider segment of skin between the breast and the axillary transverse incision, and also changed the order in which the various steps of the operation are carried out. The resulting incision about the breast was thus roughly in the shape of an arrow head (2).

The night before operation the field of operation is shaved and scrubbed with soap and water followed by the application of alcohol, and is covered with a sterile dressing. The field of preparation should extend from the line of the jaw to the umbilicus, and from the opposite anterior axillary line across the front of the chest to the midline of the back. The axilla is shaved and painted with a 25 per cent solution of aluminum chloride to inhibit perspiration, and the skin preparation is carried down the arm to the elbow. When the patient is under the anesthetic, the operative field is painted with half strength (3½ per cent) tincture of iodine, and the arm is wrapped in a sterile towel and placed on an arm

This paper was prepared as a tribute to the memory of the late Robert B Greenough with whom the authors were associated as assistants and junior colleagues over an aggregate period of 18 years.

board abducted at a right angle from the body. Use of a fairly narrow arm board permits the assistant to stand in the angle between its upper border and the upper end of the table, with draping arranged to exclude the patient's head and the anesthetist from the operative field.

The transverse axillary incision begins at the lower border of the clavicle near its mid point, that is, immediately overlying the apex of the axilla (Fig 1, inset). Medially the clavicle and first rib run roughly parallel to each other, but as the palpating finger passes laterally the depression can be felt at the lateral border of the subclavius muscle, where the rib begins to turn backward and upward. This depression forms an accurate landmark for the upper end of the incision. From this point the incision courses downward and outward, crossing the free border of the pectoralis major well on the axillary side of the upward prolongation of the breast but below the axillary hair area. Incisions that cross through the axillary hair area are likely to be a nuisance to the patient later. The incision continues to the posterior axillary fold, that is, to the latissimus border, at about the level of the lower end of the scapula. Greenough taught that this incision need not be straight. The first part could run straight downward, then curve outward across the axilla, and again turn downward in the lower part of the axilla. Thus, the upper part of the scar is covered by the shoulder straps of a woman's garments.

This incision is carried only through the skin, and then it is deepened by beveling it outward toward the insertion of the pectoralis major and toward the free border of the latissimus (Fig 1). The pectoralis major muscle is exposed only near its insertion, for there may be nodes on the anterior surface of the muscle. Near the upper end of the incision, the beveling carries the flap upward to expose the clavicle laterally.

When this axillary flap of skin has been raised completely, the pectoralis major muscle is ex-

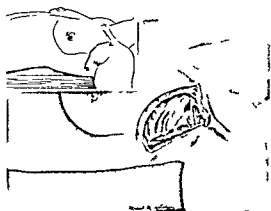


Fig 1 The transverse axillary incision 1 B (inset) starts near the mid point of the clavicle and runs downward and outward across the axilla to the posterior axillary fold. The incision is beveled outward to expose the latissimus and pectoralis major muscles near the humeral insertions

posed from its insertion along a line running roughly to the mid point of the clavicle, and in this region the fibers of the muscle are parallel to the line so exposed. A little above, the cephalic vein can be seen, and it should be spared. The insertion of the pectoralis major is divided close to the humerus and the muscle is split along its fibers up to the clavicle, leaving only a few of the lateral fibers originating from the clavicle (Fig 2).

At this point in the operation it is necessary to make a further skin incision to give free access to the apex of the axilla. This incision is the upper part of the upper and medial of the two incisions destined to encircle the breast in the shape of an arrow head (Fig 2, inset, D C). It

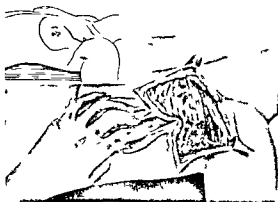


Fig 2 The pectoralis major is divided close to its insertion and the fibers are split to the clavicle. The origin of the muscle from the clavicle is divided. The skin incision D C (inset) gives greater freedom of access to the apex of the axilla.

starts from a point on the transverse axillary incision near the free border of the pectoralis major muscle, follows this downward and medially toward the breast, and then swings medially toward the sternum around the upper and medial aspect of the breast, to include all the skin overlying the breast tissue. Its exact location varies somewhat with the position of the tumor in the breast. Only the upper part of the incision is necessary at this stage of the operation. The resulting skin flap is beveled back toward the clavicle and sternum, to permit separation of the pectoralis major from the medial half of the clavicle and the upper part of the sternum.

With the pectoralis major muscle drawn downward, a little sharp dissection exposes the upper intercostal muscles and the subclavius muscle, at the border of the tendon of which the axillary vein is encountered as it enters the canal behind the muscle and between the clavicle and the first rib. Exposure of the vein for the first time at this point permits early appraisal of the extent of axillary involvement and provides at least the possibility of retreat if an incorrect estimate of operability has been made.

By means of sharp dissection, the fat and areolar tissue are then freed from the surface of the vein, working distally to the medial border of the pectoralis minor muscle. This muscle is divided near its insertion and retracted downward. As the dissection is carried distally along the vein, the individual branches of the vein are clamped before division and tied at once to avoid undue traction on the vein (Fig 3). When the lower



Fig 3 The pectoralis minor is divided near its insertion and the axillary contents stripped away from the axillary vein from the apex outward. Note the free border of the subclavius muscle marking the apex of the axilla. Note also the cephalic vein lying on the border of the deltoid muscle and its point of junction with the axillary vein. In the outer axilla the subcapular vessels and thoraco-dorsal nerve can ordinarily be preserved.

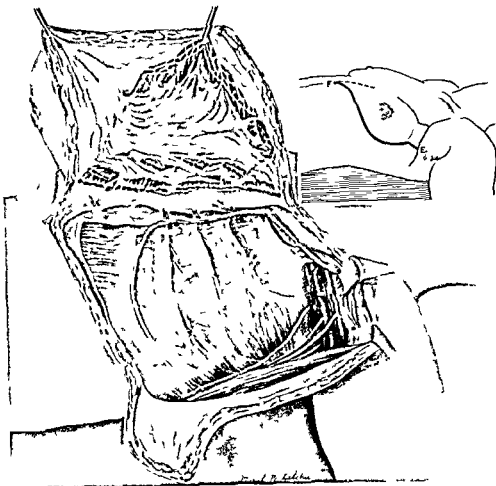


Fig 4 The incision *EF* (inset) gives access to the lower axilla and its contents are carried medially with the breast. The long thoracic nerve is encountered lying on the serratus digitations and is not disturbed. The origins of the pectoralis minor and major muscles are divided close to the chest wall. Note removal of the upper part of the rectus sheath.

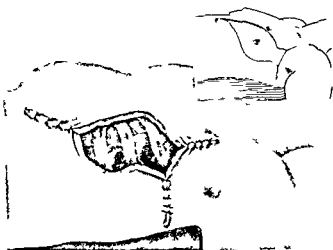


Fig 5 The specimen is finally freed from the chest wall by the incision *FG* (inset). Closure is begun at the three corners of the wound. If necessary a defect may be left on the chest wall to be closed by immediate or deferred skin graft.



Fig 6 Closure completed. Drainage may be carried out through the outer angle or through a stab wound. Note the relation of the scar to the axillary hair area. Note also that the infraclavicular scar will be concealed by the shoulder straps of the clothing.



Fig 7 Postoperative appearance of the patient. Note freedom of the function of the arm and the position of the scar.

border of the axilla is reached the dissection is carried downward along the free border of the latissimus muscle, moving medially over the teres major and the subscapular muscle to the chest wall. It is usually possible to spare the thoracodorsal nerve to the latissimus and the subscapular vessels accompanying it, but other wise all the loose areolar tissue in this region is dissected free and retracted medially with the breast. At the chest wall, the upper digitations of the serratus anterior muscle are encountered, and lying on them the long thoracic nerve. A minimum of areolar tissue is left overlying the nerve which is not lifted from its bed¹ but other wise the serratus digitations are dissected clean of their overlying fascia.

At this point it is necessary to make another skin incision (Fig 4 inset E-F). The incision begins at the transverse axillary incision about 2 inches lower than the upper one previously made, and sweeps downward and then inward around the lateral and inferior borders of the breast. This incision like the others is beveled back away from the breast to reach the chest wall well beyond the breast itself. Access is thus secured to the lowest part of the axilla and lowest serratus digitations which are dissected clean.

The breast and muscles are now lifted and retracted medially, and the muscles are separated from their origins on the chest wall (Fig 4).

When the structures are lifted in this way it is possible to see and secure vessels before dividing them. This maneuver is particularly desirable in dealing with the perforating branches of the internal mammary vessels. At the lower and medial end, more or less of the upper rectus fascia is removed, depending on the location and extent of the primary growth. Dissection beneath the breast in this fashion is carried medially to the mid sternal region or beyond, depending on the location of the primary growth.

When the hemostasis has been secured on the chest wall the breast is allowed to fall back into its normal position, and the skin incision is completed along the medial border of the breast (Fig 5, inset, F-G). This finally frees the entire specimen.

After complete hemostasis, closure is usually effected without great difficulty, due to the wide beveling of the wound and undermining of the skin. The transverse axillary incision is closed from either end. The redundancy of the lateral skin flap, of a length corresponding to the base of the removed arrow head shaped area of skin on the specimen, is drawn downward and sutured to the upper axillary parts of the two incisions which swept about the breast. Thus these two are brought together and sutured to each other, leaving a linear wound extending to the epigastrium (Fig 6). Occasionally the tension is too great and a defect must be left to be closed later by granulation or by skin graft.

¹If the nerve is lifted from its bed the nodal visual branches to the serratus digitations are of course destroyed.

GENERAL CONSIDERATIONS

There does not seem to be any very efficient method of applying skin towels to an operative wound of this kind. The best alternative seems to be to make incisions only as they are needed in the course of the operation, and to keep all parts of the wound constantly covered with hot wet packs except for the area actually in process of dissection. This procedure minimizes as much as possible the exposure to infection as well as blood loss, cooling, and drying.

We deplore the use of tenacula and double hooks in retraction on the skin flaps, although it is permissible on the muscles and skin to be removed. Excessive use of toothed forceps on the skin edges is also to be condemned. Smooth retractors, or the hand of the assistant protected with gauze, should be all that is necessary. Dissection should be sharp, either with scissors or knife, and hemostasis should be accurate and exact. In recent years we have frequently used electrocoagulation instead of ligatures on all vessels except the branches of the axillary and subscapular vessels. This method does not appear to give rise to any more serum or reaction in the wound than the ligature. Ligatures should be of fine catgut or silk.

Blood loss in this operation varies within rather wide limits, depending upon the skill of the surgeon, and it is greater in obese patients, in patients with large breasts, and in those with hypertension. In a number of routine determinations, the blood loss ranged from 200 to 800 cubic centimeters. Clamping of vessels before division, scrupulous care in hemostasis, and the use of hot gauze packs on the exposed areas, all conduce to minimize the amount of blood loss.

Drainage was a moot question among the early writers on the subject, and will continue to be. A considerable number of these wounds can be closed safely without drainage. Serum will collect in an appreciable number of these in an amount sufficient to require aspiration, or even repeated aspirations. A Penrose drain brought out at the lower end of the transverse axillary incision, or through a stab wound in the lower skin flap, usually suffices to evacuate the serum that collects immediately after operation, and can be safely removed at the time of the first dressing. A second wick in the epigastric region is sometimes needed in obese patients.

Skin sutures are best interrupted, and we find fine silk satisfactory. Great care should be taken with coaptation of the skin edges, especially in the infraclavicular portion of the wound. Where tension is great, across the middle part of the defect, a few pulley stitches may be necessary. If excessive tension is present, it is better to leave a small area to granulate than to risk devitalization and necrosis of the wound edges by use of heavier suture material in an attempt to secure closure. We have not used primary skin grafts in these cases, but have resorted to secondary-thick Thiersch grafts or small deep grafts when the defects were extensive.

At the completion of the operation, pressure should be applied to evacuate all air, serum, and blood from the wound. The dressing should be applied to press the flaps firmly against the chest wall and to obliterate all dead space. The arm should be immobilized, preferably by the use of a second binder, holding the arm close to the side with the forearm free or across the body. There is no question that immobilization of the arm not only minimizes the flow of lymph but also prevents the recreation of axillary dead space beneath the flaps.

The first dressing should be deferred for at least 2 days, and preferably for 4 or 5 days. In this dressing the drain may be removed. At least partial immobilization of the arm should be continued for from 6 to 9 days. Sutures may be removed in a week from parts of the arm where there is no tension, the remainder may be removed in 10 days. Motions of the arm are restored by active use and exercise, and the arm is free in about 3 weeks. Some sort of restriction of dressing should be retained for about a week. As a general rule, the patients are able to resume their usual occupations within a month after the time of the operation.

REFERENCES

- 1 GREENOUGH, R. B. SIMMONS, C. C. J. D. Surg., Gynec. & Obst. 1921, 10, 1, 1.
- 2 GREENOUGH, R. B. Surgical Diseases of the Breast. By Ochsner. Vol. 2, p. 121. New York, 1921.
- 3 HALSTED, W. S. Ann. Surg., 1914, 18, 1, 1.
- 4 MEYER, WILLY. New York Med. J., 1914, 110, 1, 1.
- 5 RODMAN, W. L. Diseases of the Breast. P. Blakiston's Son & Co. 1914, 1, 1.
- 6 WARREN, J. C. International Review of Surgery, 1900, 11, Vol. 2, chap. VIII.

DOUBLE PULLEY TRACTION IN THE TREATMENT OF HUMERAL SHAFT FRACTURES

LESTER BLUM, M D, New York, New York

IT IS evident that the current fashion in the care of fractures is distinctly mechanical. The literature is replete with descriptions of ingenious devices designed to facilitate the reposition and maintenance of bony fragments. To the critical observer, it would appear that the wand of Caduceus is being forsaken for the tool chest of Vulcan.

The use of mechanical appliances for the treatment of fractures is no novelty. A perusal of the Edwin Smith surgical papyrus, which was inscribed before 1500 B.C., makes this quite evident. To account for the present zeal in the exploitation of intricate apparatus, there are two apparent reasons. The first is the wide spread custom of evaluating the major aspects of any particular case in terms of the x ray plate. This attitude places a disproportionate premium on the attainment of roentgenologically accurate reduction. Second it is now stylish to force ambulation on nearly all fracture patients as early as possible. It is assumed that a shorter hospitalization is attended in practically all cases, by a more rapid convalescence, minimal disability, and a more complete return to normal. This association far from being axiomatic, is neither clinically proved nor logically tenable.

The indiscriminate employment of pins, screws, wires, bolts, nails, and their kindred devices has thus brought the problem of man and the machine to traumatic surgery. Are we in danger of losing sight of the individuality of the patient and of the individuality of his particular fracture in a maze of gadgets?

It is therefore with a sense of added responsibility that I wish to present an apparatus first used 4 years ago for the treatment of fractures of the shaft of the humerus.¹ My intention is to outline its application, advantages, and limitations in as objective a manner as is possible in clinical exposition.

The appearance of double pulley traction is shown in Figure 1. It is a multiple pulley system

directly patterned after Russell traction. It is not so eponymically designated because it functions differently, furthermore, multiple pulley systems were used for fractures 1500 years before Russell, and his name should, therefore, not be used as a generic connotation for all pulley systems. Finally, in deference to Dr. Russell we do not wish to add to the confusingly numerous modifications bearing his name.

DESIGN AND APPLICATION

As can be seen, the patient lies supine with the bed tilted by shock blocks to about 10 degrees off the horizontal to afford countertraction. A Balkan set up is used to support the pulley frame. This latter can be patterned to a size and shape appropriate to the type of bed and size of the room.

The injured arm is abducted to the desired degree so that the olecranon lies clear of the mattress. A padded sling is applied to the antecubital region with the elbow joint in extension of 110 to 130 degrees.

The continuous rope leads down from the antecubital sling to the single pulley on the horizontal arm of the frame. From there, it runs up to and around one wheel of the double pulley to the wheel on the hand cage. The rope then leads back to and around the other wheel of the double pulley to suspend the weight.

The frame is simply constructed of wood. Holes are bored at intervals in the vertical and horizontal limbs for the placement of the pulleys. The hand cage is of the ordinary type used for skin traction of the upper extremity, except that it is surmounted by a pulley wheel. It is affixed by moleskin strips applied to the volar and dorsal aspects of the forearm. This leaves the arm fully exposed as it lies on the mattress.

With some practice the injured extremity can be transferred from emergency traction to the completed arrangement of Figure 1, within 10 minutes.

This apparatus functions on the plan of a parallelogram of forces. In Figure 2 the direct and resultant lines of force are superimposed on a duplicate sketch of Figure 1. There are two

From the Surgical Service of the Beekman Street Hospital, New York, New York.

¹Blum L. The use of double-pulley traction in the treatment of fractures of the shaft of the humerus. J Am Med Ass 1933 101: 1953.

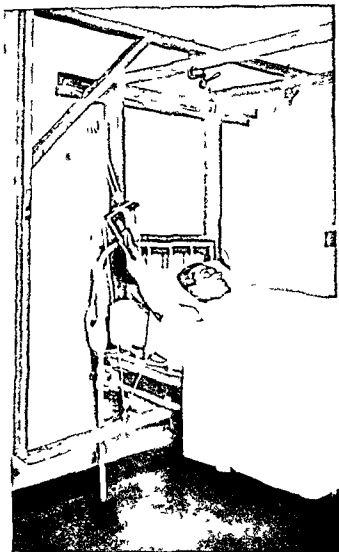


Fig 1 Double pulley traction

directions of pull. One (OB) is downward, running from the elbow in the direction of the single pulley. Its force is transmitted through the cubital cuff and it is equal to the suspended weight.

The other pull (OA) is upward, from the elbow toward the double pulley and its force is twice the suspended weight, since this is a double pulley system. The resultant force (OV) lies one-third of the intervening angle nearer the greater force (OA). This resultant represents the diagonal of the dynamic parallelogram and it is equal to a little more than twice the suspended weight. It constitutes a true axis traction force. Thus, if the weight used were 4 pounds, force OA would be 8 pounds, force OB would equal 4 pounds, and the resultant OV would approximate 9 pounds. Because of the effect of gravity on the forearm and hand cage, the direction of OA is taken as 5 degrees lower than the theoretical double force

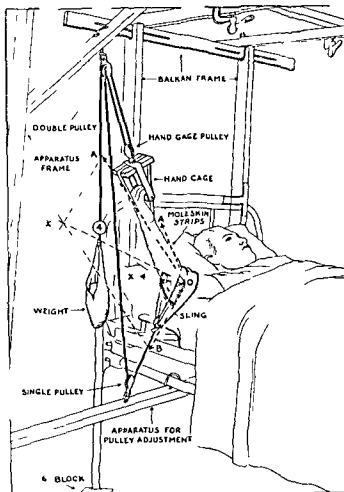


Fig 2 The mechanics of double pulley traction. OA , True double force, OB , single force, OV , resultant force, $O1'$ apparent double force, $O1'$, axis of fragments. When IOB is a right angle, IOB is twice $IO1$. $IO1$ (approx. 20°) compensates for (1), sinking of patient in bed, (2), sagging and friction of the apparatus, (3) pressure of mattress at the fracture site.

$O1'$ which runs from the elbow directly to the double pulley.

In the typical case, the moleskin strips for the hand cage are applied to the forearm before the extremity is removed from emergency traction. This will allow them to become firmly adherent to the skin before any tension is placed on them, thus avoiding the necessity of substitution during the course of treatment. The frame is set at the desired degree of abduction, the rope strung through the pulleys, and the sling put in place.

The initial weight is determined by the muscular development of the individual and by the extent of soft tissue injury. In general, it is advisable not to exceed 5 pounds for men, 4 pounds for women, and 3 pounds for children and adolescents. It has, in fact, been our experience that these are initial, maximal figures and must, as a rule, be reduced sometime during the

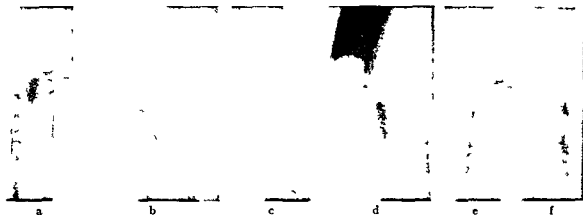


Fig. 3. Case 1. a Anteroposterior view at 5 hours. Overriding is evident. b Lateral view at 5 hours. Anterior angulation of 40 degrees. c Anteroposterior view. Angles

adjusted. X-ray film taken at 24 hours. Angulation of 20 degrees. d Lateral view. e Anteroposterior view at 48 hours. f Lateral view.

first week of treatment because of the danger of overpull.

If the plane of the mattress on which the arm rests (OV) is considered to be 180 degrees then the double pulley should as a preliminary position be so placed that the forearm is suspended (double force OB) about 50 degrees above the mattress or at 230 degrees. The single pulley, below, should be adjusted so that the rope leading from the sling (single force OB) lies about 40 degrees below the mattress plane or at 140 degrees. With this initial arrangement the resultant (OV) will be directed about 20 degrees above the mattress (180 degrees) plane (OV), which is also the plane of the proximal fragment. In practice, this 20 degrees upward correction has been found to be necessary since the sinking of the patient in the bed, the sagging and friction in the apparatus and the upward pressure of the mattress at the fracture site all tend so to alter the direction of axis traction.

Anteroposterior and lateral roentgenograms are taken within 12 hours and check up films, thereafter, at indicated intervals. If overriding is present the problem is one of obtaining sufficient traction over a sufficiently long period of time since this type of angulation is caused by insufficient pull. It has nothing to do with the angles involved. However, if full length has been obtained and an anterior angulation is present then an adjustment of the angles to alter the direction of the resultant is necessary.

This is done by first measuring the actual deviation on the roentgenogram with a protractor. The reading in degrees represents the divergence between the working resultant and the desirable one. This discrepancy is then eradicated by

appropriate movement of one or both pulleys. Any change in position of the double pulley which affects the direction of force OA is twice as effective in changing the direction of the resultant as a similar movement of the single pulley which alters the direction of single force OB . The protractor is again employed in this maneuver, by placing its fulcrum at the elbow and directing its arms toward the pulleys to locate OA and OB and so calculate OV . The pulleys can then be moved without disturbing the continuity of traction so as to obtain the desired direction for the resultant OV .

In this connection it may be mentioned that when the pulleys are approximated, i.e., when angle AOB becomes smaller, the force of the resultant (OV) becomes greater and vice versa. However, it has been our custom to move both pulleys when necessary thus leaving angle AOB unchanged.

Posterior angulation is rare, occurring once in 24 cases arising as a result of simultaneous overpull and maladjustment of the angles. Lateral angulation is referable to the degree of abduction and may also be present with slight overriding.

From this description of its proved functions it can be readily appreciated that double pulley traction possesses those mechanical traits which make it an easily adjustable definitive method of obtaining axis traction.

ADVANTAGES AND LIMITATIONS

Our experience with this apparatus has been particularly gratifying because it has revealed that double pulley traction when properly and pertinently used does work. In short, a discussion of its angles, forces, and resultants does

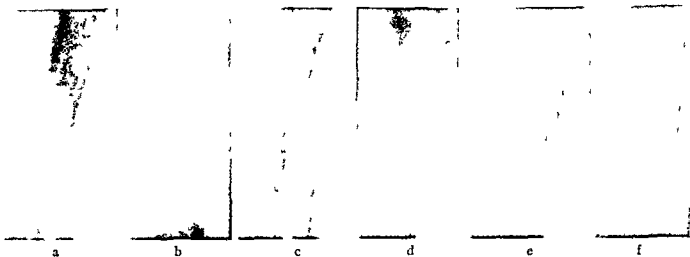


Fig 4. Case 2 a, Anteroposterior view X ray film taken after 18 hours b, Lateral view c Anteroposterior view Angles have been adjusted to correct axis X ray

film taken at 4 weeks d Lateral view e, Anteroposterior view Roentgenogram taken at 8 months f, Lateral view

not constitute a pretty speculative gossip, but represents the effective application of the simplest laws of physics to a clinical problem

The advantages of double pulley traction are
1 It is a comfortable, easily adjustable form of axis traction which can be used in definitive fashion for the treatment of fractures of the distal half of the shaft of the humerus

2 The entire arm is exposed thus facilitating the care of any soft tissue wounds, the taking of roentgenograms, and the application of physiotherapy to the injured area

3 This apparatus is equally applicable to children and adults since there is no trauma to bone (as is the case where pins and wires are

used), no irritation of the skin, and no residual injury to the neighboring joints

4 Its use does not interfere with the proper care of shock, nor does it hinder the simultaneous treatment of other injuries

Its disadvantages are

1 As a method of permanent extension, it requires the constant supervision of the house and nursing staffs

2 As a peculiarly effective form of traction, it is prone to cause overpull unless it is carefully watched

3 The average period of hospitalization is 6 weeks (This is not to be confused with the period of disability which is probably shortened)

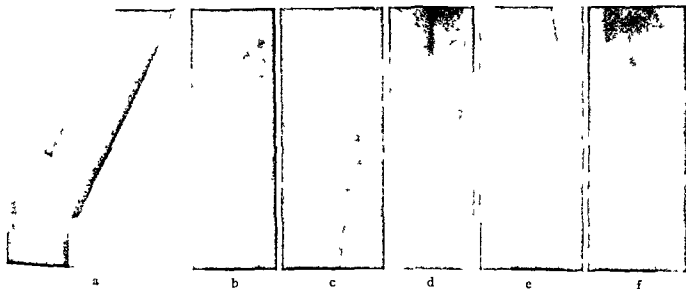


Fig 5. Case 3 a Anteroposterior view X ray films taken on admission b Lateral view c Anteroposterior view Angles have been adjusted Roentgenogram taken

at 3 days d, Lateral view e, Anteroposterior view Roentgenogram taken at 3 months f, Lateral view



Fig 6 Case 4 a Anteroposterior view Gun hot wound X ray film taken at 15 hours b Lateral view c Anteroposterior view Wounds healed. X ray film

taken at 4 weeks. d, Lateral view e, Anteroposterior view Roentgenogram which was taken at 4 months. f Lateral view

The indications for its use have been arrived at, and properly so on an empirical basis. This will be evident in the following case reports.

In our experience double pulley traction has proved a method of choice in the treatment of fractures of the shaft of the humerus below the deltoid tubercle and of compound fractures in any part of the shaft.

CASE REPORTS

The following cases have been treated by members of the surgical staff of the Beekman

Street Ho-pital, each surgeon using the apparatus where and when he thought it indicated.

CASE 1 (Fig 3) FS a robust 37 year old white male, was admitted to the ho-pital on April 20, 1936 shortly after being struck by a cab. He suffered a transverse fracture in the middle third of his right humerus. Admission x ray films revealed marked angulation with overriding despite strong emergency traction. After 6 hours in 5 pound double pulley traction there was still $\frac{1}{2}$ inch overriding. At 24 hours full length had been obtained, but there was a 30 degree angulation on the lateral view. At 48 hours, this had been corrected by appropriate adjustment of the angles of the apparatus. On the eleventh day

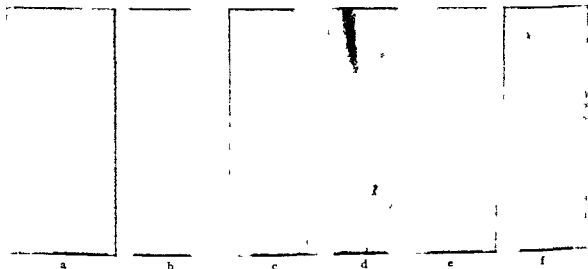


Fig 7 Case 5 a Anteroposterior view X ray film taken at 27 days. Weight reduced. Angulation b Lateral view c, Anteroposterior view X ray film taken 2 weeks

later Angles adjusted. Weight changed d, Lateral view e, Anteroposterior view X ray film taken at 6 months. f Lateral view

the weight was reduced to 4 pounds but despite this, overpull became apparent on the fifteenth day. Callus was visible on the twenty fifth day and by the thirty second day, the fragments had been re approximated but with some angulation. There was a complication of phlebitis in the right leg with subsequent pulmonary embolization which prolonged the hospital stay until July 11, 1936. Because of the overpull, clinical union was delayed until June 25, 1937.

This case exemplifies the efficient function of the apparatus in correcting angulation. Despite care in trying to avoid its occurrence, overpull did take place, with its usual sequelae of delayed union and prolonged hospitalization.

CASE 2 (Fig. 4) C F, a 30 year old white male was admitted to the hospital on October 15, 1934 shortly after a fall on his left arm. He had a T fracture which began near the middle of the shaft of the humerus and extended into the elbow joint thus separating the capitulum and trochlea. X ray films showed a 25 degree anterior angulation after a few hours in 5 pound double pulley traction. The angles were adjusted and at 48 hours the alignment was improved to one of 5 degrees of deviation. A cock up splint was applied to the wrist because of symptoms of radial nerve contusion. The position was maintained for 37 days, at which time the callus was satisfactory and union sufficiently firm to discard the traction. He was discharged on November 25, 1934. Follow up examination at 2 years showed an A4, E4, F4 result.

This type of fracture is a most difficult one to handle. The excellent anatomical and functional result is a tribute to the efficacy of this apparatus. In particular, the attainment of complete, painless elbow joint function is worthy of note.

CASE 3 (Fig. 5) J R, a 66 year old white male, was admitted to the hospital on October 5, 1934 several hours after falling down a flight of stairs. Roentgenograms showed an oblique fracture in the middle third of the right humerus with definite angulation. After 36 hours of 5 pound double pulley traction, some angulation persisted. Accordingly the pulleys were adjusted and the weight increased to 7 pounds. Twenty four hours later anatomical alignment was attained and the original 5 pound traction restored because of slight overpull. An excellent position was maintained for 53 days in traction because of delay in union (overpull). Some callus had been evident at the twenty fourth day. The patient was discharged on December 1, 1934. Follow up examination at 5 months revealed complete function of the shoulder except in the extremes of rotation and all other joints were normal. An A4, F4, F3 (unemployed) result had been obtained.

CASE 4 (Fig. 6) J C, a 39 year old white male, was admitted to the hospital on March 21, 1934 20 minutes after his left upper arm had been shattered by a charge of buckshot. There was an extensive, compounded, comminuted fracture of the upper third of the left humerus. Following cleansing of the wounds the extremity was placed in 4 pound double pulley traction. The fragments were maintained in this fashion while the arm was left free for dressings throughout the period of hospitalization. Callus was evident at 26 days and the wounds were healed 1 week later. The patient was out of traction on the forty third day. Follow up examination at 10 months revealed an A4, E4, F4 result.

CASE 5 (Fig. 7) V S, a 46 year old white male, was admitted to the hospital on May 1, 1935, shortly after falling from a ladder. He suffered a short oblique fracture in the middle third of his right humerus. For the first 16 hours, 7 pound double pulley traction was applied. At the end of that period, there was a suggestion of overpull and the weight was reduced to 5 pounds, and the abduction increased from 45 to 75 degrees. By the twentieth day the weight was reduced to 3 pounds in an effort to correct the overpull, but this resulted, despite increasing callus, in an angulation of 25 degrees by the twenty sixth day. Correction was obtained by restoring the weight to 6 pounds without disturbing the angles. Firm union in the anatomical position was present by the fourth day. He was discharged on June 21, 1935. Examination at 11 months showed an A4, with the elbow joint deficient in the last extension.

This case demonstrates that to occur when more than 5 degrees of angulation is present. Once overpull is present, it can be gained by reducing the weight with the angles. The end result is satisfactory.

CASE 6 E K, a 48 year old man, was admitted to the hospital on March 5, 1935, after striking his head on a stair railing. He had a comminuted impacted fracture of the neck of the left humerus. The fracture was placed in 5 pound double pulley traction. On the section did not affect continued until the used. The fracture of the fourth week. Traction was discharged 7 months show rotation but.

This case shows a pulley 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

to

revealed patient was and he was treated.

CASE 8 N R, a 40 year old white male, was admitted to the hospital on February 1, 1935, after being struck by an automobile. He had a comminuted fracture of the body and neck of the left humerus. The fracture was placed in 5 pound double pulley traction. The fragments were maintained in this fashion while the arm was left free for dressings throughout the period of hospitalization. Callus was evident at 26 days and the wounds were healed 1 week later. The patient was out of traction on the forty third day. Follow up examination at 10 months revealed an A4, E4, F4 result.

GCPJ-70
DOCTOR K
Sawyer, M.D.
S No
Title
Vol
Borrower's No
Duo Date
Bor A

142
3-11-83
65 Year
100

pound Blake board traction suspension. At 3 days there was some improvement but the skin of the arm began to blister. At 10 days 5 pound double pulley traction was instituted for two reasons. First the brachial skin was breaking down and second a more effective pull was indicated. Thereafter there was some further improvement and on the twentieth day the extremity was removed from traction with excellent motion of the shoulder.

This case demonstrates the advantageous use of double pulley traction without regard to its axis traction qualities. An effective comfortable pull of 11 pounds replaced the skin damaging 7 pound (effective 4 pound) pull of Blake board extension.

CASE 9. R.P. a 12 year old white female was admitted to the hospital on May 31 1935 a few minutes after falling over a box and sustaining an irregularly transverse fracture in the lower third of the shaft of her left humerus. After 18 hours in 4 pound double pulley traction there was still some overriding with transposition of the fragments. The fracture site was manipulated under general anesthesia and the extremity then returned to 5 pound traction. At 4 days an anatomical position had been obtained but because of slight overpull the weight was reduced to 3 pounds. Twenty four hours later x ray examination showed a 10 degree anterior angulation due to the weight reduction. With the aid of the protractor the angles were altered so that accurate reduction was restored within 48 hours. At 25 days there was good callus and clinical union. Traction was removed at 28 days and coaptation splints were applied. The patient was discharged on June 29 1935. Follow up examination at 10 months revealed an A4, E4, F4 result.

CASE 10. N.A. a 15 year old negro was admitted to the hospital on May 1 1933 shortly after suffering an oblique fracture in the distal third of the shaft of his right humerus. The extremity was placed in 3 pound double pulley traction. After 9 hours 1/2 pound was added. X ray examination at 20 hours showed good alignment with a 5 degree anterior angulation. At 3 days an extra sling was introduced which caused an anterior angulation of 22 degrees within 24 hours. The sling was removed and by adjusting the pulleys this was corrected to one of 10 degrees. At 17 days callus was evident and by the thirty seventh day union was sufficiently firm to remove the traction. At 40 days union was solid and the patient was discharged.

This was our first case. The trouble with the extra sling proved a fortunate event since it demonstrated that angulation could be promptly corrected by proper adjustment of the angles.

CASE 11. J.G. a 14 year old white male was admitted to the hospital on August 6 1933 shortly after his right arm had been caught between two trucks resulting in a transverse fracture in the middle third of the humerus. The extremity was placed in 3 pound double pulley traction. Roentgenograms at 9 hours revealed a 20 degree anterior angulation. The pulleys were then adjusted to elevate the direction of the resultant. At 2 days the fragments were in anatomical position. The weight was reduced to 2 pounds to avoid overpull. At 4 weeks there was a fair amount of callus present. At 7 weeks union was solid and the patient was discharged. Follow up examination at 14 months revealed an A4, L4, F4 result.

This patient was maintained in traction for so long a period because of his lack of co-operation.

CASE 12. L.C. a 65 year old white female was admitted to the hospital on June 21 1936 with a fresh oblique fracture in the upper third of the right humerus. The extremity was placed in 2 pound double pulley traction. There was some angulation which was still present at the eleventh day, when because of the danger of hypostatic pneumonia 5 pound Blake board traction was substituted. In this way the patient could be propped up. On the twenty fifth day a plaster spica was applied and the patient was discharged on July 15 1936.

This case was one for an ambulatory method of treatment from the start. Unless the criteria for the proper use of double pulley traction can be satisfied, its use is contra indicated.

CASE 13. B.R. a 48 year old white male was admitted to the hospital on March 29 1936 20 minutes after falling from a ladder. He sustained a skull fracture with brain injury in addition to a comminuted fracture of the surgical neck of the left humerus. The extremity was put up in 6 pound Blake board extension. After 1 week the skin on the arm began to break down. Since bed rest was still enforced by the cranial injury, it was felt that the arm might as well benefit by continued traction. Therefore 2 pound double pulley traction was instituted. On the twenty eighth day callus was present and traction was discontinued. He was discharged on April 28 1936. Follow up examination at 5 months revealed some limitation in full abduction in extension and in the extremes of internal rotation. The elbow was normal.

CASE 14. J.F. a 43 year old white male was admitted to the hospital on January 30 1936 after being caught between two trucks. He suffered multiple injuries and shock as well as a short oblique fracture through the middle third of the left humerus. Because of angulation and overriding 6 pound double pulley traction was applied. After several hours overpull was evident on the roentgenogram and the weight was reduced on successive days in an attempt to approximate the fragments. This was naturally unsuccessful and on the fifteenth day the patient's condition was sufficiently good to allow of open operation. A Lane plate was inserted and convalescence was satisfactory. Callus appeared on the thirty seventh day and the patient was discharged on March 22 1936.

This case can be summarized with the one word "overpull." Where the patient is enervated by shock or multiple soft tissue injuries, particular care must be taken not to apply too much weight.

CASE 15. H.F. a 60 year old white male, was admitted to the hospital on July 26 1935 shortly after slipping on the street and sustaining a comminuted fracture through the upper third of the right humerus. The extremity was placed in 5 pound double pulley traction and an excellent position was obtained and maintained. On the twentieth day callus was evident and the weight was reduced to 2 pounds. Traction was removed on the thirty first day and the patient was discharged with the arm in coaptation splints on August 30 1935.

CASE 16. R.P. a 65 year old white male was admitted to the hospital on January 22 1935 with a history of having fallen against a desk several hours before. Roentgenograms revealed an impacted fracture of the surgical neck of the right humerus also involving the greater

tuberosity Double pulley traction of 6 pounds was applied because of the impaction The extremity was gradually abducted with the fragments in good position However his general condition was not deemed satisfactory and a plaster spica was accordingly applied in order to get the patient out of bed He was discharged in this on February 4, 1935

In general, there would seem no indication for the use of this apparatus in fractures of the upper shaft and surgical neck, unless compounded In this case, it was employed merely as an effective comfortable means of obtaining strong traction

CASE 17 S R., a 69 year old white male was admitted to the hospital on November 10, 1936, shortly after being run over by a truck He suffered multiple fractures including a compound splintered fracture in the lower extremity of the right humerus The patient was treated for shock, as well as for the local injuries Blake board traction of 4 pounds was applied to the right arm After 48 hours it was evident that this was inadequate and 4 pound double pulley traction was used Roentgenograms after 72 hours revealed definite improvement with good alignment and approximation of the condyles The soft tissue wound was readily dressed and remained clean At the end of 2 weeks, the patient expired because of broncho pneumonia and exhaustion

This case again serves to demonstrate that double pulley traction is most effective in the distal half of the humerus

CASE 18 F T., an 18 year old white female was admitted to the hospital on January 10, 1933, with an irregularly transverse fracture through the surgical neck of the left humerus Because of the marked impaction with some malalignment, 5 pound double pulley traction, in 30 degrees of abduction, was applied After 24 hours angulation with rotation was evident and a manipulation under anesthesia was necessary On the fifth day, a second manipulation was performed, without success Twenty-four hours later a third manipulation was done with successful retention by extending the extremity directly overhead It was retained in this fashion until the twenty-third day The patient was discharged on February 6, 1935 Follow up examination at 4 months revealed complete shoulder function

Double pulley traction was used here because we had as yet not learned that it had nothing to offer in the treatment of simple fractures proximal to the deltoid tuberosity

CASE 19 M A., a 20 year old white female was admitted to the hospital on October 1, 1936 after falling 4 stories to the street She suffered 5 major fractures in addition to a compounded, comminuted, supracondylar fracture of the right humerus extending into the joint The extremity was placed in 3 pound double pulley traction The original position was one of overriding of the fragments with separation of the condyles and a 20 degree anterior angulation Within 24 hours this was corrected to one of good alignment, complete correction of the angulation, and approximation of the condyles This position was maintained until the patient expired on the sixth day

In this type of fracture, double pulley traction is the optimal method of treatment because

plaster retention would be ineffective due to shipping, manipulation is impossible because of the hazardous condition of the patient, and finally the soft tissue wounds can be satisfactorily dressed

CASE 20 F R., a 28 year old white male, was admitted to the hospital on April 15, 1934, 1 hour after being thrown from a horse The injuries were confined to the left upper extremity They were a transverse fracture in the upper third of the humerus, fractures of both radial and ulnar styloid processes, fracture of the navicular, and dislocations of the os lunatum and os magnum The carpal injuries were reduced by manipulation, and, simultaneously an unsuccessful attempt was made to reduce the humerus fracture, but the fragments could not be maintained in position Accordingly, the arm was placed in 6 pound double pulley traction in adduction On the fourth day, another manipulation was unsuccessful At the end of the second week, when the skin was in good condition, an open operation with insertion of a Lane plate was performed The patient was discharged on May 17, 1934 Follow up examination at 18 months revealed an A4, E4, F4 result

It is a clinical fact that any form of traction is ineffective in the reduction and maintenance of transverse fractures just below the surgical neck of the humerus

CASE 21 T W., a 44 year old white male, was admitted to the hospital on November 8, 1934 several hours after a fall in the street He suffered an oblique fracture in the middle third of the right humerus The extremity was placed in 6 pound double pulley traction in a 30 degree abduction At the end of 48 hours, the position of the fragments was improved At 5 days, a manipulation under general anesthesia was deemed necessary At four weeks, the weight was reduced to 4½ pounds, and there was fair callus formation Traction was removed on the thirty-third day, union was solid The patient was discharged on December 17, 1934 Follow up examination at 5 months revealed an A3, F3 (out of job) result

CASE 22 M R., a 38 year old white female, was admitted to the hospital on December 9, 1935, shortly after falling downstairs She sustained an oblique fracture in the lower third of the shaft of the humerus The arm was placed in 6 pound Blake board traction At 6 days there was a persistent 20 degree anterior angulation Double pulley traction of 4 pounds was then applied Within 24 hours, the angulation was corrected and the alignment remained good until she was discharged from the hospital Follow up at 8 months revealed an A4, E4, F4 result

CASE 23 C S., a 55 year old white male, was admitted to the hospital on January 27, 1936, after a fall from an elevated platform There was a comminuted oblique fracture of the upper third of the right humerus extending into the surgical neck, with considerable rotation of the fragments Double pulley traction of 5 pounds was applied in full abduction The following day, a manipulation under local anesthesia was performed and traction was resumed The improved position was maintained with 3 pounds, after the fifth day Callus was evident at 4 weeks and the patient was discharged on March 23, 1936, with a returning function of the shoulder

CASE 24 J L., a 21 year old white female, was admitted to the hospital on August 28, 1934, shortly after a fall. She sustained a fracture of the surgical neck of the left

humerus The extremity was placed in 3 pound double pulley traction the arm being gradually abducted to 90 degrees within 24 hours At this time, x ray examination showed a medial angulation of 30 degrees obviously due to the abduction The weight was increased to 5 pounds on the eleventh day a manipulation under general anesthesia was performed with no success Callus was evident at 9 days and traction was removed at end of sixth week Follow up at 10 months revealed an $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{4}$ result.

Double pulley traction has nothing to offer in the care of a fracture of the surgical neck, unless

there is a soft tissue wound and extension is otherwise indicated

CONCLUSION

The indications, advantages, and limitations of double pulley traction are presented on the basis of its use in the treatment of 24 cases of fracture of the humerus It has proven itself to be a definitive, axis traction apparatus which gives excellent results when properly employed

UTERINE CURETTAGE AS AN AID IN THE DIAGNOSIS OF ECTOPIC PREGNANCY

R S SIDDALL M D and CHARLES JARVIS, M D Detroit Michigan

ALTHOUGH extensive investigation has been devoted to the diagnosis of ectopic pregnancy the variable clinical aspects of the condition still offer many difficulties in its recognition Indeed different studies give the incidence of incorrect diagnoses as ranging from 15 to 40 per cent In doubtful cases with obscure symptoms and signs provided there is sufficient time, properly interpreted pregnancy tests can sometimes be of assistance A recent report by Hope indicates that peritoneoscopy (laparoscopy) may become a valuable aid One would think that this procedure, if it proves to be not too difficult or dangerous should at least displace aspiration by needle of the posterior cul de sac for the discovery of free blood in the pelvis

In 1936 one of us published an article (7) on the association of decidual reaction of the endometrium with extra uterine pregnancy in which it was concluded that in the case of at least some patients the findings at uterine curettage could be of considerable value in differential diagnosis The material for this investigation consisted of the patients with extra uterine pregnancy who were operated upon at Harper Hospital during the 5 year period ending March 31, 1935 An examination of patients with similar conditions occurring in the next 2 years was found to confirm the first in all essentials For the present study, then the two groups are combined thus giving a more substantial series for statistical purposes

From the Department of Obstetrics and Gynecology Harper Hospital

In the previous article a review of the literature showed a remarkable disagreement among authors of textbooks as to the diagnostic usefulness and reliability of curettage in ectopic pregnancy Some stressed it as important, others as unreliable Still others thought curettage too dangerous in extra uterine pregnancy for use in diagnosis Many made little or no mention of the procedure, and the same can be said for authors of articles in the periodical literature A recent exception is Mathieu, who found curettage of great diagnostic assistance in 2 cases

Considering the dangers first a rather careful review of the literature for the last 10 years yielded no convincing data to support the opinion noted above Moreover, in the records of our cases there was nothing to indicate that curettage had been harmful Indeed, it does not seem that a properly performed curettage should be as likely a cause of rupture of the pregnant tube as the usual bimanual pelvic examination

If it is true, then that curettage is not unduly dangerous, the importance of the matter is to be found in the degree of reliability or usefulness of the procedure Again referring to the previous paper, it may be considered as established that in any pregnancy, uterine or extra uterine, the endometrium undergoes characteristic decidual changes With uterine pregnancy there will be fetal or chorionic tissue (chorionic villi) in addition to decidua The presence or not of chorionic villi has long been considered as possibly significant in differential diagnosis Later observations have shown that, though there may be a

slight chance of error, the presence in the uterus of decidua alone is at least strong presumptive evidence of extra uterine pregnancy. On the other hand, the absence of decidual changes in the endometrium cannot be taken as dependable evidence against ectopic pregnancy, since the decidua is usually cast off subsequent to death of the ovum. The latter, though no longer developing, may still be a cause of internal bleeding. However, even in such event, the absence of villi in the findings at curettage, and regardless of the type of endometrium, could be of distinct value at times in ruling out uterine abortion as a cause of the symptoms.

In view of the foregoing evidence that curettage is not unduly dangerous in ectopic pregnancy and that it can possibly be of considerable diagnostic assistance in obscure cases, we have studied the 38 Harper Hospital cases of definite extra-uterine pregnancy with available specimens of endometrium. These were found among the 171 patients who were treated by operation during the 7 year period ending March 31, 1937. In each instance the diagnosis was proved by the extra-uterine presence of a fetus or chorionic villi. The specimens of endometrium for the 38 cases were obtained by uterine curettage in 29, by hysterectomy in 6, and by decidual cast or discharged fragments in 3.

By accepting for study none but proved cases of ectopic pregnancy, we have attempted to avoid possible errors in some of the other reports. Furthermore, the specimens of endometrium from our cases were diagnosed in the laboratory before the full hospital records were consulted in regard to the duration of bleeding and other clinical features. Nor, do we question the reliability of the majority of the histories as the women were, with two exceptions, private patients and therefore probably for the most part sufficiently intelligent and informed to give a good account of their symptoms. We have indicated indefinite or questionable data in Table I by plus and minus signs or question marks. It is unfortunate from the standpoint of accuracy that we have been able to trace, for comparison, only a few instances of suspected extra-uterine pregnancy with curettage, but in which some other condition was found at operation. Some of these were incomplete abortions with decidua and chorionic villi in the curettings, in no case was there intact decidua alone.

In Table I the 38 Harper Hospital cases are arranged according to days elapsing between the onset of abnormal bleeding and the time when the endometrium was obtained. There is also shown the number of days since the last normal men-

TABLE I—HARPER HOSPITAL CASES OF EXTRA-UTERINE PREGNANCY—SHOWING DURATION OF VAGINAL BLEEDING AND TYPE OF ENDOMETRIUM

Harper Hospital case number	Specimen obtained by	Last menstrual period—Days before specimen obtained	Onset of hemorrhage—Days before specimen obtained	Endometrium Type or phase
1 15918	Curettage	49	1	Intact decidua
2 84937	Curettage	50	4	Intact decidua
3 96097	Curettage	54	4	Intact decidua
4 57104	Pieces expelled	66	5	Intact decidua
5 50450	Curettage	48	5	Intact decidua
6 132863	Curettage	56	7	Intact decidua
7 143117	Curettage	35	7	Intact decidua
8 144637	Decidual cast	46	8	Intact decidua
9 131450	Curettage	42	9	Intact decidua
10 114405	Curettage	67	10	Intact decidua
11 112073	Decidual cast	64	11	Intact decidua
12 117726	Curettage	48	11	Proliferative
13 93097	Curettage	45	13	Intact decidua
14 90394	Curettage	52	14	Intact decidua
15 103507	Curettage	10?	14	Proliferative
16 129130	Hysterectomy	42	15	Intact decidua
17 87923	Curettage	?	18	Intact decidua
18 103241	Curettage	77?	18	Proliferative
19 63808	Hysterectomy	65	23	Intact decidua
20 129918	Curettage	72	23	Proliferative
21 43171	Curettage	25?	25	Early decidua
22 113163	Curettage	62	27	Proliferative
23 144919	Curettage	48	28	Intact decidua
24 138922	Curettage	70	28	Proliferative
25 117457	Hysterectomy	62	28	Proliferative
26 143043	Hysterectomy	63	28	Proliferative
27 111788	Curettage	51	30	Early secretory
28 57923	Curettage	90+ or -	30	Early secretory
29 88276	Curettage	76	32	Decidual glands
30 42519	Hysterectomy	75	34	Intact decidua
31 113045	Curettage	79	34	Proliferative
32 80620	Curettage	56?	36	Intact decidua
33 127346	Hysterectomy	1	36	Proliferative
34 47228	Curettage	117?	63?	Middle secretory
35 97919	Curettage	94+ or -	65+ or -	Intact decidua
36 125414	Curettage	140	70	Proliferative
37 131261	Curettage	109	72	Proliferative
38 113305	Curettage	146+ or -	85+ or -	Proliferative

TABLE II—FIVE SERIES OF EXTRA UTERINE PREGNANCIES SHOWING INCIDENCE OF DECIDUA ACCORDING TO ONSET OF ABNORMAL BLEEDING BEFORE ENDOMETRIUM WAS OBTAINED

Onset of abnormal bleeding before specimen secured	Series	Cases	Decidua	Percent age
None to 1 week	Sampson	3	2	100.0
	Geist and Matus	11	10	99.9
	Moritz and Douglas	12	3	16.7
	Boerner	11	10	90.9
	Harper Hospital	7	7	100.0
	Total	43	31	72.1
1 to 2 weeks	Sampson	3	1	33.3
	Geist and Matus	11	7	63.6
	Moritz and Douglas	12	2	16.7
	Boerner	4	1	25.0
	Harper Hospital	8	6	75.0
	Total	38	17	44.7
2 to 3 weeks	Sampson	1	0	0.0
	Geist and Matus	6	1	16.7
	Moritz and Douglas	6	1	16.7
	Boerner	7	3	42.9
	Harper Hospital	5	2	40.0
	Total	25	7	28.0
3 to 4 weeks	Sampson	2	2	100.0
	Geist and Matus	4	2	50.0
	Moritz and Douglas	11	1	9.1
	Boerner	4	1	25.0
	Harper Hospital	8	3	37.5
	Total	29	9	31.0
4 to 5 weeks	Sampson	12	0	0.0
	Geist and Matus	6	3	50.0
	Moritz and Douglas	3	1	33.3
	Boerner	4	0	0.0
	Harper Hospital	12	4	33.3
	Total	47	8	17.0
All cases		185	71	38.4

strual period, the method by which the endometrium was secured, and the endometrium type or phase. It is seen that where abnormal bleeding had lasted 10 days or less, intact decidua was found in every instance. After this time there was an increasing incidence of the cyclic phases of the endometrium and in one instance (Case 29) partially desquamated decidua was found. However, it is noteworthy that intact decidua was present several times following prolonged bleeding—with of course, the same diagnostic significance. As stated before, even when intact decidua is not present the absence of chorionic villi in the curettings could be taken as evidence against uterine abortion. Although this series contains too few cases for definite statistical conclusions, the results are sufficiently striking to indicate that those who have opposed diagnostic curettage in extra uterine pregnancy have greatly underrated the value of the procedure.

In the literature there are at least four other series of ectopic pregnancies which give sufficient data to permit a comparison with ours. In order of publication these are tabulated in Table II along with ours so as to show the occurrence of decidua in relation to the duration of abnormal bleeding. It is evident that 3 of these series (those of Sampson, of Geist and Matus, and of Boerner) show a general agreement with ours, the differences being explained possibly by the small numbers involved or by different criteria in the selection of cases for study. Moritz and Douglas reported the only series showing little or no relationship between the occurrence of decidua and the duration of bleeding. However, even with the inclusion of their exceptional findings, averages calculated from all 5 series (which together form a group of substantial size) indicate a high incidence of decidua with recent onset of abnormal bleeding. Furthermore, it is seen that although the incidence of decidua decreases with increased duration of bleeding, this significant finding may be expected in some cases even after prolonged bleeding.

The impression regarding the value of curettage which is obtained from the foregoing data is substantiated by the clinical records of the 29 patients in our series who were subjected to diagnostic curettage. The histories of these 29 patients show that the duration of abnormal bleeding varied from 1 to 85 days (Table I). The majority presented obscure symptoms and signs, yet in 15 there was intact decidua without chorionic villi—a finding presenting a high degree of diagnostic probability and usefulness. The following case was of this group.

CASE 1 J. B. aged 34 years. Married 10 years with 1 full term pregnancy 5 years before the present illness, no miscarriages. The pregnancy occurred after 4 years of sterility for which treatment had been given. The last menstrual period was on March 20, 1936. Beginning on April 2 and lasting for 3 days there had been lower abdominal cramps such as usually occurred with menstruation. Several days later there was a dull pain which gradually became like a toothache and was more marked in the lower left quadrant. On May 15 two nights before admission slight vaginal bleeding began.

Patient was admitted to the hospital on May 17, 1936. Blood pressure was 108/68, temperature 99 degrees, pulse, 80, hemoglobin 81 per cent, white blood count, 10,100. Abdominal palpation showed diffuse tenderness below the umbilicus and vaginal examination gave in denate findings except for tenderness in the region of the left adnexa. On May 19 the Friedman reaction was positive for pregnancy. Two days later curettage yielded a large amount of material and the operator believed he was dealing with an incomplete abortion. However, microscopic examination of the curettings showed typical decidua reaction of the endometrium but no chorionic villi. At abdominal operation on May 23 a very small amount of free blood was found in the pelvic cavity, and also an

unruptured left tubal pregnancy measuring 1 by 1 3/4 inches in which was later found a fetus. The left tube was removed. Convalescence was uneventful, and the patient was discharged from the hospital on June 6, 1936.

The following case is illustrative of the group in which decidua was not present but in which the findings were, nevertheless, of some importance.

CASE 2 W B, aged 33 years. Married for a number of years but never pregnant. The last regular menstrual period began on December 18, 1935. On February 21, the patient experienced a sudden lower abdominal pain. The pain continued and on the following day was so severe that she fainted. Vaginal bleeding began at this time and was continuous for a week. "Spotting" followed and at one time clots and a sort of "skin" were passed. This tissue was not examined microscopically. Shortly after the onset of the Friedman test for pregnancy was positive. Moderate abdominal pain continued intermittently.

Because of persistence of the symptoms, the patient was admitted to the hospital on March 15, 1936. The blood pressure was 128/80, pulse, 90, hemoglobin, 77 per cent, and white blood count, 7,900. History and examination at this time suggested tubal abortion (left) or incomplete uterine abortion. On March 16 examination under anesthesia revealed a mass 3 by 3 centimeters in size apparently attached to the left cornua of the uterus. Uterine curettage at the same time yielded a moderate amount of tissue which on microscopic examination was found to be endometrium in the proliferative phase. There were no chorionic villi. At abdominal operation on March 18 a "small amount of free blood was found in the abdominal cavity." The omentum was adherent to the bladder and over the uterus, adnexa, and sigmoid. After separation of the adhesions, the gangrenous left tube and the ovary were seen to be involved in old blood clot and adhesions. The left tube and ovary were removed with difficulty. Except for several days, on which the patient was febrile, the course following operation was satisfactory and the patient went home on March 28, 1936.

SUMMARY

In view of the frequent difficulties met with in the recognition of ectopic pregnancy, a study was made of uterine curettage as a diagnostic aid. The procedure is apparently not unduly dangerous, and the finding of intact decidua without chorionic villi is strong presumptive evidence of extra uterine pregnancy. In 38 cases of proved ectopic pregnancy with available specimens of endometrium, intact decidua alone was present in all cases with abnormal bleeding of 10 days or less and in a considerable proportion of those with more prolonged bleeding. The absence of decidual reaction is not reliable evidence against ectopic pregnancy. However, if chorionic villi are also absent, the findings may be of value in ruling out uterine abortion as a cause of the bleeding. Three of 4 somewhat comparable series found in the literature confirmed our results in large part. Two illustrative case reports are given.

Note—We wish to take this opportunity to thank Dr P F Morse for permission to use the pathological material from the Laboratory of Harper Hospital.

BIBLIOGRAPHY

1. BOERNER, R. *Ztschr f Geburtsh u Gynaek*, 1931, 101, 763.
2. GRIFFITH, S H and MATHEW, M R. *Am J Obst & Gynec*, 1929, 17, 151.
3. HOPE, R B. *Surg Gynec & Obst*, 1937, 64, 229.
4. MATHIEU, A J. *Am M Ass*, 1937, 108, 366.
5. MORITZ, A R, and DOUGLAS, M. *Surg, Gynec & Obst*, 1928, 47, 785.
6. SAMPSON, J A. *Surg, Gynec & Obst*, 1914, 18, 587.
7. SIDDALL, R S. *Am J Obst & Gynec*, 1936, 31, 420.

POSTERIOR GASTROJEJUNOSTOMY

An Unusual Error in Technique

J M McCAUGHAN M D F A C S, and W T COUGHLIN, M D, F A C S,
St. Louis, Missouri

TEXTBOOKS of surgery and special monographs dealing with the technique of retrocolic gastrojejunostomy not infrequently fail to give definite instructions for the proper placing of the anastomosis with relation to the middle colic artery. For example Fowler in 1906 stated "A slit is made in the transverse mesocolon at the point where it is in relation to the posterior wall of the stomach." Moynihan in 1908 wrote "The jejunal direction being carefully noted, the transverse mesocolon is divided at a spot devoid of blood vessels close to the duodenojejunal flexure." Mayo-Robson in 1910 said, "A vertical slit is then made in the transverse mesocolon between the blood vessels which are readily seen." Moynihan in 1904 again wrote, "At a bloodless spot in the arch of the middle colic artery a clip is applied to the under surface of the mesocolon." In 1904 Warbasse described the procedure as follows, "A small vertical incision is made in the mesocolon at this point between the blood vessels." The point referred to is the under surface of the mesocolon which is made to bulge when the stomach is pressed forward against it. Bickham in his *Operative Surgery*, 1934 is more accurate; he writes "The mesocolon is caught with forceps and drawn away from the posterior stomach wall while its structure is divided by knife or scissors through a non-vascular area just to the left of the duodenojejunal junction." Horsley, 1928, gave this description "The stomach and transverse colon are lifted out of the wound making taut the transverse mesocolon which is divided for 7 centimeters between vessels exposing the posterior wall of the stomach." Romanis and Mitchner, 1929 say, "A large opening is made in the mesocolon at a bloodless spot and the posterior wall of the stomach is pushed through this." In Nelson's *Surgery* Walton states "The mesocolic artery should be identified and the bloodless area to the left of it freely incised." and Horsley in Lewis' *Practice of Surgery* says, "An incision is made in the mesocolon about the midline or slightly to the left, avoiding the large

blood vessels." Babcock's *Textbook of Surgery*, 1935, evidently quotes from Horsley, "The stomach and transverse colon are lifted out of the wound making taut the transverse mesocolon which is divided for 7 centimeters between the vessels exposing the posterior wall of the stomach." Probably the most complete description appears in a recent monograph by Eusterman and Balfour, 1936. "The transverse colon is then elevated and the mesocolon inspected for the most suitable area through which the segment of the stomach selected for the anastomosis is to be drawn and in this selection there is usually no difficulty. Occasionally, however, there may be a choice in the arcades of the mesocolon as they have been formed by vessels of the branches of the mesocolic vessels; if there is, the arcade farthest to the left side of the patient should be chosen."

No special emphasis apparently seems to have been given to a discussion of possible dire results, if this point be disregarded and the anastomosis be made through the mesocolon to the right of the middle colic artery. A review of the literature since 1901 fails to reveal any mention of instances of malfunction due to occlusion of the jejunal limbs by the vascular pedicle as a result of failure to place the anastomosis to the left of the middle colic vessels. It will be remembered that the middle colic artery is a branch of the superior mesenteric artery which latter springs from the front of the aorta just above the level of the root of the transverse mesocolon (Fig 1). This middle colic artery is a vessel of quite some importance inasmuch as it carries the blood supply to the middle portion of the colon and, if it is injured, it is probable that the consequence will be serious. It is accompanied by the middle colic vein which brings the blood back from the same portion of the colon, pouring it into the superior mesenteric vein, which latter, joining the splenic, forms the portal vein. These two vessels, then—the middle colic artery and vein—form in the mesocolon a strand of some thickness, the artery at its beginning being about as thick as the brachial, and the vein is correspondingly large. One can now understand that when the individual stands or sits the transverse colon sags and the middle colic

artery is brought closer to the superior mesenteric artery from which it springs. Of course, when seen during the performance of this operation, a wide interval separates these two arteries, perhaps more than a right angle, depending on the distance to which the colon has been drawn up. Now the duodenum, as it goes on to become the jejunum, passes behind the superior mesenteric artery. If one remembers this he can easily visualize what happens when the first 3 inches of jejunum are picked up and drawn to the right of the median line (Fig 2). The loop, both limbs of it, must come to lie in front of the superior mesenteric artery. If now, while it is thus drawn over to the right of the midline one were to return the colon to its natural position, the loop—both limbs of it—would be constricted between the middle colic vessels and the superior mesenteric vessels, as though between the blades of a clamp or scissors (Fig 2a). But, furthermore, if now the summit of the loop is made to pass through the mesocolon to the right of the midcolic vessels and is then fastened to the stomach to the *left* of the midline, the constricting action of these vessels is intensified. And now, the summit of the curve is, we think, practically always anastomosed to the stomach to the left of the midline (as it should be whenever possible). Thus our loop will have made a half circle around the vessels—the middle colic artery and vein—and the more the stomach falls away to the left—as in the act of filling—just so much the more must the midcolic vessels constrict both limbs of the loop, and also just so much the more must the vessels be constricted by the loop. If the stomach is sewed firmly to the edge of the opening in the mesocolon and adheres firmly to it, the condition will be bad enough, but surgeons of experience know these

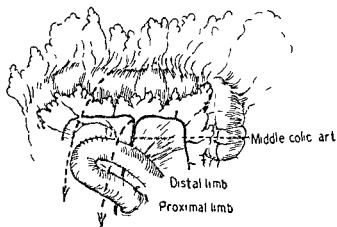


Fig 2 One can visualize what happens when the first 3 inches of jejunum are picked up and drawn to the right of the midline

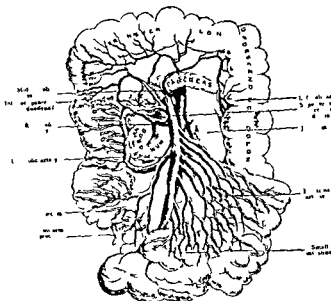


Fig 1 This illustration shows how the middle colic artery and vein and the superior mesenteric vessels are widely separated when the transverse colon is drawn up and indicates the manner in which a loop of jejunum could be compressed as between the arms of a pair of pincers on replacement of the colon were the gastrojejunal anastomosis made to the right (patient's) of the middle colic vessels (After Jackson)

two do not always adhere strongly and that, in fact, it is common enough to find a goodly loop going through and up to the stomach—even when a 'no loop' operation has been done, and if such should occur after the opening in the mesocolon is made to the right of the middle colic vessels the results are more likely to be poor.

The following is a report of a patient studied by us in whom pain and regurgitant vomiting occurred as a result of obstruction to the proximal

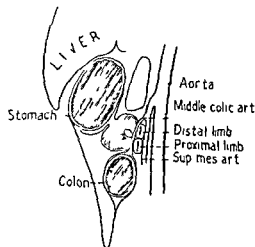


Fig 2a When the colon is returned to its normal position, both limbs of the loop are caught between the middle colic vessels and the superior mesenteric vessels as between the blades of a clamp or scissors



Fig. 3. Pre-operative gastric roentgenogram. Note the dilatation of the duodenum and the gastro-enterostomy stoma. Barium was seen to leave by the distal limb but did not enter the proximal limb. Old entero-enterostomy not functioning. Reverse peristalsis active in duodenum.



Fig. 3a. Postoperative gastric roentgenogram. The duodenum was now able to empty satisfactorily through the enlarged entero-enterostomy. The gastro-enterostomy is functioning fairly well as before.

and distal limbs of the loop of the jejunum due to failure to observe this principle.

H.C. male white 32 years of age was admitted to the Firmin Desloge Hospital on January 22, 1936 complaining of pain in the epigastrium and of indigestion. Nine years previously on October 27, 1927 in another institution this patient had a posterior gastro-enterostomy and an appendectomy performed for duodenal ulcer. Shortly after operation he developed regurgitant vomiting which on November 7, 1927 required a second operation for relief. An operative note made at that time stated that the omentum and transverse colon were firmly adherent to the line of incision on the right side and that the proximal loop of the jejunum was considerably distended and kinked at an acute angle by adhesions to the stomach. There was also an apparent obstruction at the gastro-enterostomy stoma. This was relieved by an entero-enterostomy made between the proximal and distal loops of the jejunum. The incision was made to the left of the midline as the first operative wound had become infected. The patient immediately was relieved of his acute obstructive symptoms but continued to have attacks of epigastric pain at intervals as before. Since 1933 following an injury to his back in an automobile accident his gastro-intestinal symptoms have become progressively worse. The earlier attacks were relieved by food and bicarbonate of soda but at present these are of no benefit and the pain is almost constant with acute exacerbations at times of more severe pain radiating to the shoulder blades associated with vomiting. In the past month he has lost

strength and at least 10 pounds in weight. Family and past histories are irrelevant to the present complaint.

On physical examination the patient appeared undernourished and in considerable distress because of pain in the upper abdomen. The head and neck were negative. Examination of the heart and lungs revealed nothing abnormal. The abdomen was scaphoid and there were 2 old operative scars in the upper abdomen—one on either side of the midline. The scar on the left was healed firmly while that on the right was the seat of a postincisional type of hernia situated at its middle third and measuring approximately $3\frac{1}{2}$ inch in width and $1\frac{1}{2}$ inches in length. There were no palpable masses and the liver and spleen could not be felt. There was a definite point of tenderness in the epigastrium to the left of the navel on deep palpation. There was tenderness also in the region of McBurney's point. The extremities were essentially negative. The systolic blood pressure was 95 millimeters of mercury and the diastolic 68 millimeters of mercury.

On laboratory examination the urinalysis was negative. There were 8,000 leucocytes, 52,000 erythrocytes and 13.3 grams hemoglobin. The differential blood count was normal. The blood Wassermann and Kahn tests were negative. The blood non protein nitrogen was 37 milligrams per 100 cubic centimeters and the blood sugar was 85 milligrams per 100 cubic centimeter. Gastric analysis showed free and combined acids within normal limits. The bleeding and clotting times were normal. Roentgenographic examination of the chest revealed an old bronchitis. A ray examination of the stomach (Fig. 3) revealed a gastro-enterostomy stoma which was not functioning properly. The barium could be seen passing

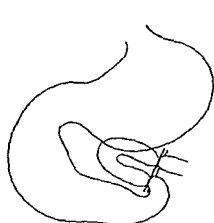


Fig 4



Fig 5

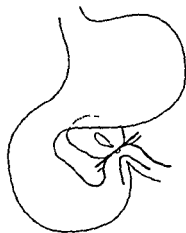


Fig 6

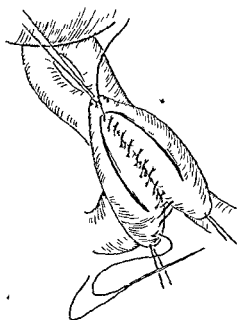


Fig 7

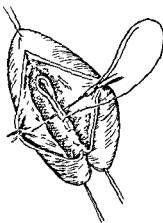


Fig 8

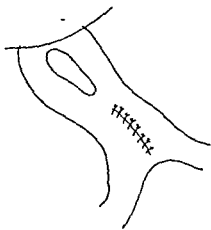


Fig 9

Fig 4 Probable sequence of events in this patient at the time of the original operations. The anastomosis has been made to the right of the middle colic vessels. The two jejunal limbs are compressed and obstruction developed rapidly.

Fig 5 An entero-enterostomy between proximal and distal limbs is done with relief of obstructive symptoms.

Fig 6 The entero-enterostomy gradually becomes constricted with recurrence of obstructive symptoms. The solid line indicates the site of the new corrective anastomosis.

Figs 7, 8, and 9 Steps in the operative procedure. A Finney pyloroplasty type of anastomosis is made between the duodenum and the jejunum distal to the site of obstruction.

through the distal loop of bowel. It did not enter the proximal loop. There was a deformity of the first part of the duodenum with associated tenderness and fixation due to adhesions. The barium passed through the pyloric ring of the stomach into the duodenum. The second and third portions of the duodenum were dilated and showed evidence of reverse peristalsis. The barium in this loop of bowel did not pass through the old entero-enterostomy stoma, which was suggestive of an obstruction there. A diagnosis of duodenal ulcer and malfunctioning gastro-enterostomy with chronic duodenal obstruction was made and exploratory operation recommended.

While the patient was being prepared for operation a furuncle was discovered in the region of the proposed line of incision. This was opened and a small amount of pus

was evacuated. Operation was thus delayed. As the lesion did not heal an exploration was made on March 3, 1936, and a sinus tract was found in the old right rectus abdominal scar. This was explored and proved to be rather extensive. It was lined with granulation tissue and lay across the long axis of the old operative scar and led ultimately through the abdominal wall in the direction of Morrison's pouch. A small amount of pus was encountered. The anterior wall of the portion of the tract through the abdominal musculature was unroofed and packed with iodoform gauze. The patient was discharged from the hospital shortly thereafter to await healing of this old chronic wound infection.

He returned on June 8, 1936, and on June 12, 1936, the abdomen was explored. The scar of the first operation

was excised and the stomach and transverse colon were found adherent to the sac of a postoperative hernia. Numerous loops of small intestine were freed of adhesions and the gastro-enterostomy and entero-enterostomy stomas were at length revealed. The gastro-enterostomy admitted only 1½ fingers but seemed to empty fairly well into the distal jejunal limb but the proximal limb of the jejunum was twisted and compressed by the middle colic vessels apparently because the anastomosis had been made to their right side rather than to their left. The entero-enterostomy stoma had contracted to such an extent that it was ineffectual in draining the duodenum which was enormously dilated in its second and third portions. Figures 4, 5 and 6 show the probable sequence of events following the original operations. The anterior wall of the duodenum in the first part was scarred and firmly adherent to the under surface of the liver.

The old entero-enterostomy was then enlarged by making a Finney pyloroplasty type of anastomosis between the proximal and distal limbs of the jejunum proximal to the point at which the middle colic artery crossed the two jejunal limbs (Figs 7, 8 and 9). The hernia was then repaired in the usual manner by imbrication. The patient had a satisfactory convalescence and was discharged from the hospital on July 4, 1936 and has since returned to work. He reported on February 4, 1937, that he has been entirely free of all symptoms since operation and that he is able to do hard labor. The wound is firmly healed and there is no tenderness on deep palpation anywhere in the upper abdomen. On March 8, 1937 the stomach was re-examined with the barium meal (Fig. 3a). The constriction at the gastro-enterostomy was still evident. A fair amount of barium passed through the distal limb of the gastro-jejunojejunostomy loop. The duodenum was no longer dilated and the barium passed through the entero-enterostomy opening with greater ease than before indicating an enlargement of the stoma. The duodenum was still distended and painful to pressure but to a lesser degree.

A direct attack was not made on the ulcer itself but our efforts were directed rather toward improving gastroduodenal and jejunal mechanics. There seemed to be no urgent need for taking down the malfunctioning gastro-enterostomy inasmuch as the stomach content passed easily into the duodenum through the pylorus. The prime difficulty lay apparently in the inability of the latter to empty itself. The choice of entero-enterostomy was felt justifiable at the time because it was the more easily performed operation and because it was a much less serious procedure than would have been the case in any attempt to undo the two previous anastomoses. Subsequent events have shown that the results were every thing that could have been desired. We are aware that it may be necessary later to deal directly with the ulcer itself. That intestinal obstruction either partial or complete may be caused by the unyielding compression of an adherent vascular pedicle is shown by the occasional reports of congenital anomalies of the duodenum with obstruction at the duodeno-jejunal angle. Judd and White, in 1929, reported 2 such cases in which there was constriction by a

band of peritoneum stretching from the superior mesenteric vein for a distance of 3 inches distally. In one of these patients the peritoneal fold only was liberated and in the other a duodeno-jejunojejunostomy was performed with good results.

While we do not pretend to any priority in calling attention to the complication noted in our case we do believe that the principle of making the approach to the posterior wall of the stomach to the left of the middle colic artery possibly deserves more emphasis than it has hitherto been accorded. The technique of posterior gastro-jejunojejunostomy has been fairly well standardized and the results from a technical standpoint are today reasonably good in most clinics, nevertheless at least 20 different complications due to imperfections in the technique of posterior gastro-jejunojejunostomy have been recorded in the literature. Fortunately the majority of these sequelae are rarely seen.

CONCLUSION

In performing posterior gastro-enterostomy the transverse mesocolon should be opened in the arch of the vascular arcade of the middle colic artery and to the left of this vessel. The opening should be made in an avascular area at a point close to the duodenojejunal flexure.

REFERENCES

1. BABCOCK, W. W. *Text Book of Surgery*. Philadelphia W. B. Saunders Co. 1928.
2. BICAHAM, W. S. *Operative Surgery*, p. 842. Philadelphia W. B. Saunders Co. 1924.
3. ELSTERMAN, G. and BALFOUR, D. C. *The Stomach and Duodenum*. Philadelphia W. B. Saunders Co. 1936.
4. FOWLER, G. R. *A Treatise on Surgery*. Philadelphia W. B. Saunders Co. 1906.
5. HORSLEY, J. S. *Operative Surgery*. St. Louis The C. V. Mosby Co. 1928.
6. Idem. *Surgery of the Duodenum Exclusive of Diverticula*. In Lewis' *Practice of Surgery*, Vol. 6, 1-29. Hagerstown, Md. W. F. Prior Inc. 1929.
7. JUDD, C. S. and WHITE, R. B. Congenital anomalies of the duodenum with obstruction at the duodeno-jejunal angle. *Ann Surg.* 1929, 80, 1-5.
8. MAYO ROBSON, A. W. *Surgery of the Stomach*. In Keen's *Surgery*, Chap. 49, 825-965. Philadelphia W. B. Saunders Co. 1910.
9. MONTAGAN, B. Operations upon the Stomach. In Kelley and Nobel's *Gynecology and Abdominal Surgery*, Vol. 2, 318-382. Philadelphia W. B. Saunders Co. 1908.
10. Idem. *Abdominal Operations*, 3d ed. Vol. 2. Philadelphia W. B. Saunders Co. 1914.
11. ROMANUS and WITCHNER. *Science and Practice of Surgery*, Vol. 2. New York. William Wood & Co. 1929.
12. WALTON, A. J. *Surgery of Stomach and Duodenum*. In Nelson's *Loose Leaf Living Surgery*, Vol. 43-260. New York T. Nelson & Son. 1923.
13. WARBASE, J. P. *Surgical Treatment*, Vol. 2. Philadelphia W. B. Saunders Co. 1920.

NEPHRECTOMY VERSUS CONSERVATIVE OPERATION IN UNILATERAL CALCULOUS DISEASE OF THE UPPER URINARY TRACT

GORDON D. OPPENHEIMER, M.D., F.A.C.S., New York, New York

STIMULATED by certain recent clinical problems, the question of primary nephrectomy in lithiasis of the upper urinary tract was again raised. In an attempt to answer this query, the late results following nephrectomy and conservative operative procedures were determined. In this institution a systematic follow up service has been in existence since 1928 following the establishment of a unit history system in 1926. Approximately 85 per cent of the patients who were operated upon because of calculous disease between the years 1928 to 1933, inclusive, have been observed for 1 or more years, and on an average of 4 years.¹

Following operation, these patients were frequently examined, and x-ray pictures routinely taken at yearly intervals. If the symptoms warranted it, x-ray pictures were taken more frequently or complete urological investigations were performed. While the total number of patients is not large and an average of 4 year follow up study does not by any means give the ultimate results of operative therapy, it is felt that these observations will in a general way indicate the results of our therapy. Since late recurrences of renal calculi do occur, a 10 to 15 year follow up study would be a very desirable effort. Even though there are a number of such late cases under observation on this service, there are so many patients of this period who have been lost from observation, that it would be difficult to draw statistical conclusions from such a study.

The postoperative care of the patients included efforts to eradicate renal infection by diet, medication, and sometimes by repeated pelvic lavage. Diets were prescribed after analyses of the calculi were performed in an effort to prevent the hyperexcretion of the known components of the calculi removed. Other diets and medication were used to control, if possible, the hydrogen-ion content of the urine. To prevent recurrence of alkaline stones, acidification was desired and in the patients with uratic stones, alkalinization was carried out.

From the Surgical Service of Dr. Edwin Beer, The Mt. Sinai Hospital, New York, New York.

¹These statistics are based on follow up observations which extend up to May 1936 inclusive.

This study is based on 422 patients with proved renal or ureteral calculi who were admitted to the Ward Service during the 6 years between 1928 and 1933, inclusive. Of these, 312 patients had unilateral calculous disease while 110, or 26 per cent, had bilateral disease. It must be remembered that there were a number of patients (between 30 and 40) each year with symptoms suggesting the presence of renal or ureteral calculi but in whom the diagnosis though suspected was not confirmed. The records of these patients have not been included in this group. If the unproved cases had been included, they would have increased the percentage of unilateral disease and decreased the percentage of bilateral disease.

The term bilateral calculous disease of the urinary tract is often loosely used to denote simultaneous calculi in both kidneys or ureters at the time of observation. In this study, a patient is considered to have bilateral disease when calculi are known to have occurred on either side at any time as judged by the history, by the hospital studies, or by the follow-up observations. For example, although a patient at the time of observation or operation shows evidence of a stone in only one kidney, the past or later history of stone formation on the opposite side leads to the classification of the case as bilateral. In evaluating the statistics of this group of patients, it must be remembered, too, that they were all patients who were sick enough to be admitted to the hospital wards.

In judging the comparative value of conservative operation for renal calculus, the most important questions to be answered are as follows: (1) What is the mortality? (2) What is the likelihood of recurrence of calculi? (3) What is the frequency of residual calculus with further stone formation despite modern technique with operative x-ray control? (4) What are the factors regulating the frequency of recurrence? (5) What is the frequency of later secondary operation?

The statistics from this clinic are somewhat discouraging. Table I contains data concerning 169 conservative kidney operations (both primary and secondary) performed in the above men-

TABLE I—ALL PATIENTS—UNILATERAL—BILATERAL—ASEPTIC—INFECTED CASES—PRIMARY AND SECONDARY OPERATIONS, 1928–1933

Operation	Pyelolithotomy	Pyelonephrolithotomy	Nephrolithotomy	Total conservative kidney operations (a)
Total number of operations	91	47	37	169
Mortality Number	4 (b)	2 (c)	6 (c)	12
Percentage	4.4	4.9	16.2	7.1
Not followed	12	2	2	16
Followed	75	37	29	141
Followed with residual stone	67	15	17	109
True recurrence Number	10 (d)	8	5	23
Percentage	14.9	32.0	29.4	21.7
Residual recurrence Number	8 (d)	1	12	32
Percentage	10.6	32.4	41.4	23.7
Total true recurrence and residual Number	18	9	17	55
Percentage	24.0	54.0	58.6	39.0

Note (a) In this tabulation no consideration has been given to the occasional case in which resection of a portion of the kidney has been performed in addition to the conservative operation.

Note (b) The occurrence of 4 deaths appears to be a high mortality (4.4 per cent) for the rather harmless procedure of pyelolithotomy. An analysis of these cases, therefore, is in order. Sixty patients had a pyelolithotomy performed for a single stone with a death a mortality of 3.3 per cent. Thirty-one patients had pyelolithotomy for multiple or dendritic stones with 2 deaths. Abstracts of these cases follow.

Note (c) Deaths occurred in patients with bilateral dendritic calculi.

Note (d) Pyelolithotomy for single stone was performed on 50 patients. There were no residual recurrences and there were 6 true recurrences or 12 per cent. Pyelolithotomy was performed on 25 patients with multiple (1) and dendritic stones (4) with 8 residual recurrences and 4 true recurrences or 24 per cent.

CASE 1. No. 56912. B. K. female aged 23 years. Solitary right kidney with dendritic calculus and acute pyelonephritis. Patient was in uremia. Pyelolithotomy with decapsulation was performed as a last resort but the patient died. (Also abstracted in text see Case 6.)

CASE 2. No. 150587. S. M. male aged 57 years. This patient had tabes dorsalis and residual urine 130 ounces due to neurologic bladder. A left pyelolithotomy was performed for multiple stones in a hydro-nephrotic kidney. Patient died 21 days later in uremia with a large dendritic calculus.

CASE 3. No. 10407. E. M. female aged 68 years. Patient was ill for 2 weeks with chill and fever. A right uretero-pyelolithotomy was performed. Urinary 1 single renal calculus. At operation a perforated ureter was found with a perinephric abscess. The kidney was decapsulated. The patient died 13 days after operation. Necropsy showed a chronic purulent pyelonephritis thrombophlebitis of the renal vein and pulmonary embolism.

CASE 4. No. 112577. L. S. male aged 33 years. A simple posterior pyelolithotomy for uric acid stone was performed on this patient. He died 4 days later following immediate and continuous hyperpyrexia. Necropsy demonstrated the cause of death. Sepsis was suspected although the blood cultures were negative.

tioned 6 year period, both unilateral and bilateral, aseptic and infected cases. Of these, 141 operative results were followed.

The indications for these operative procedures on this service are as follows. Pyelolithotomy is performed for single and multiple or dendritic

stones situated in the pelvis or in the calyces or in both but easily removed through the pelvis. Pyelonephrolithotomy is performed for numerous stones or dendritic stones which cannot be completely removed through the pelvis and in which additional small and sometimes larger nephrotomies are needed to remove the calculi. The nephrotomy is also sometimes used for purposes of drainage. Nephrolithotomy is performed for large dendritic and multiple calculi which cannot be removed through a pelvic incision and where drainage for infection may be needed, and in all cases in which the kidney cannot be completely mobilized and delivered. In 33 patients, in whom there was a probability of incomplete removal of stones, operation was with x-ray control according to the technique described by Beer (3).¹

The mortality for pyelolithotomy was 4.4 per cent, for pyelonephrolithotomy 4.9 per cent, for nephrolithotomy 16.2 per cent, and the average for all the operations was 7.1 per cent. The nephrolithotomized patients were, of course, the more acutely ill and had the most advanced calculous disease with infection. In fact the 2 deaths after pyelonephrolithotomy and the 6 deaths after nephrolithotomy all occurred in patients with bilateral dendritic calculi. The seriousness of operation in this type of patient is thus strongly emphasized.

In Tables I and II we have differentiated true recurrences from the residual or pseudorecurrences. The latter are so classified when stones or stone fragments are known to have been present immediately after operation. These data were obtained by routine control x-ray examinations at the time of discharge from the hospital. However, as far as the patient is concerned, the total incidence of true recurrence and residual recurrence is the important factor. The incidence of true recurrence was calculated on the basis of the number of true recurrences in relation to the total number of patients operated upon and followed less the number of patients with proved residual calculi. The incidence of residual or pseudorecurrence was determined on the basis of the number of residual recurrences in relation to the total number of patients operated upon and followed. The true recurrence rates in the total group of patients (Table I) for pyelolithotomy, pyelonephrolithotomy, and nephrolithotomy were, respectively, 14.9 per cent, 32.0 per cent, and 29.4 per cent, the residual recurrence rates were 10.6 per cent, 32.4 per cent, and 41.4 per cent, respectively, while the totals of the true recur-

¹Since the use of this technique operative attempts to remove stones have been made in patients who previously would not have been surgically treated or who would have been nephrectomized.

TABLE II

	Total number of	True recurrence	Residual	Total number less residual	Per cent true recurrence	Total number of	True recurrence	Residual	Total number less residual	Per cent true recurrence
	All followed cases (Table I)									
Pyelolithotomy	75	19	8	6	14.0					
Pyelonephrolithotomy	37	8	12	25	32.0					
Nephrolithotomy	9	5	12	17	20.4					
Total operations	121	32	32	100	21.1					
	Single stones					Multiple or dendritic stones				
Pyelolithotomy	50	6	0	50	12.0	25	4	8	17	23.5
Pyelonephrolithotomy	5	0	0	5	0.0	32	8	12	20	40.0
Nephrolithotomy	12	4	0	12	33.3	17	3	12	5	20.0
Total operations	67	10	0	67	14.9	74	15	32	47	31.0
	Stones with clear urine					Stones with grossly infected urine				
Pyelolithotomy	50	5	2	45	10.4	25	5	6	19	26.3
Pyelonephrolithotomy	14	1	5	9	11.1	23	7	7	10	43.7
Nephrolithotomy	8	2	1	7	28.6	21	3	11	10	30.0
Total operations	72	8	8	64	12.5	69	15	24	45	33.3
	Stones unilateral					Stones bilateral				
Pyelolithotomy	50	6	4	46	11.0	25	4	4	21	10.0
Pyelonephrolithotomy	22	4	5	17	23.2	15	4	7	8	50.0
Nephrolithotomy	16	1	3	13	23.1	13	2	9	4	50.0
Total operations	88	11	12	6	17.1	53	10	20	11	30.3
	Stones kidney good function					Stones kidney diminished function				
Pyelolithotomy	57	5	3	53	9.4	18	5	4	14	35
Pyelonephrolithotomy	13	4	8	5	80.0	24	4	4	20	20.0
Nephrolithotomy	18	4	4	14	28.6	12	2	8	3	33.3
Total operations	88	13	16	72	19.0	53	10	16	37	27.0
	Stones kidney normal structure					Stones kidney structural abnormality				
Pyelolithotomy	50	5	5	45	11.1	25	5	3	22	22.7
Pyelonephrolithotomy	14	1	4	10	30.0	21	3	8	15	33.1
Nephrolithotomy	10	1	2	8	3.5	19	2	10	9	22.2
Total operations	74	11	11	63	17.4	67	12	21	46	26.1
	Stones primary operation					Stones secondary operation				
Pyelolithotomy	74	10	8	66	15.2	1	0	0	1	0.0
Pyelonephrolithotomy	31	7	11	22	31.8	4	1	1	3	33.3
Nephrolithotomy	16	3	3	13	23.1	13	2	9	4	50.0
Total operations	121	20	22	101	10.8	18	3	10	8	37.5

rence and residual rates were 24.0 per cent, 54.0 per cent, and 58.6 per cent, respectively. These rather horrifying figures show the importance of controlling the residual calculus situation besides the problem of true calculus recurrence. This frequency of "left over" calculi was emphasized by Barney some years ago.

The report of Cabot and Crabtree, in 1915, contained statistics which were very disconcerting. Following 66 conservative kidney operations for stone, they found that 40 per cent of the patients were not well. Since this time many reports have appeared in the literature. Unfortunately, some of these do not indicate in detail exactly how the statistics were arrived at. Unless one knows the type of material studied, the duration of the

follow-up, the percentage of cases followed, whether questionnaire or personal and roentgenographic check up were employed, whether or not allowances have been made for residual calculi, etc., it is difficult to evaluate the reported results. At the Congress of the International Society of Urology at Rome in 1924, a symposium was presented on the late results of the operative treatment of renal calculi. DeLlyes has published a comparative table of the collected statistics of these and other authors.

Because the percentage of recurrences in our series is high as compared with other recent statistical studies, the possible reasons therefore should be discussed. In the first place the patients have been very carefully and personally observed

for an average of over 4 years. We have been very liberal in judging of recurrences. Thus, if a patient after operation gives a history of colic on the same side with the passage of a stone, the patient is considered to have had a recurrence even though the x ray examinations are negative and the patient is well. The patients have been subjected to frequent follow up x ray examinations so that recurrences have been frequently discovered in patients who were completely asymptomatic. These statistics are higher, too, because the indications for conservative operation have been extended to patients who in previous years would have been nephrectomized or not operated upon at all. The method of calculating the percentage recurrence on the basis of the total number of patients operated upon and followed less those with proved residual or overlooked fragments or stones makes the rate higher than if the basis were the total number of patients operated upon alone. However this is necessary since we have no way of knowing what would have happened to the patients with residual recurrences if these had not been present. Eighteen of the 141 patients followed after operation had had secondary operations on the same kidney. Seventeen patients had had multiple operations either on the same kidney or the opposite one. Included in these are 7 patients with so called "malignant calculous disease." These patients statistically considered elevated the recurrence rate since they showed recurrences after each of their 2 operations, and in one patient 3 operations. It must be emphasized too that only ward cases have been used in this study, or patients in the lower social strata who have not been able to look after themselves properly and who have sought advice late in their illness. Our impression is that the results among our private patients are much better.

The value of the technique of operative x ray control in this particular group of patients must be recognized. It must be realized that the patients in whom operative x ray control was carried out usually presented more complicated cases than those in whom it was not used, except in cases of nephrolithotomy in which the kidney could not be delivered to do an x ray control. Of 74 patients with multiple or dendritic calculi, operative x ray control was performed in only 33, or 44.6 per cent. At the present time, this technique is employed in a greater percentage of these cases. While the percentage of residual calculi was somewhat less in the group of patients in whom operative x ray control was performed than in those without x ray control, the real advantage of this procedure is apparent on con-

sideration of the following: 33 patients had operative x ray controls. In 15, stones or stone fragments which could not be palpated or found without the x ray were located and removed. In 10, although stone fragments were seen on the x ray control plate, they could not be located and removed. It must be remembered that in several cases further exploration and x ray procedures were contra indicated by the seriousness of the patient's general condition while on the operating table. X ray control showed no stones or fragments remaining in the kidney in 22 patients. This was proved to be correct in 19 patients and incorrect in 3 as verified by postoperative x ray pictures taken on discharge from the hospital ("discharge x ray control").

Table II classifies the recurrences (true recurrences) according to various factors for purposes of comparison. For example, with single stones, the recurrence rate after pyelolithotomy is 12.0 per cent, while with multiple or dendritic stones it is 23.5 per cent. The uninfected or slightly infected cases which are classified as stones with clear urines carry an average recurrence rate of 12.5 per cent for a total of all operations performed, which is contrasted with a recurrence rate of 33.3 per cent in cases with grossly infected urines. When the calculous disease is unilateral the operation a primary one for single stone with clear urine, and the kidney is relatively normal in structure with good function, the recurrence rate is lower, i.e., about one half of the recurrence rate when the opposite set of conditions prevail. It is realized that, although tabulated separately, these factors often are naturally associated, sometimes as cause and effect. Thus, stasis of the kidney with hydronephrosis will show diminished function and possibly gross infection.

With reference to the recurrence rate in relation to the chemistry of the removed calculi, for all operations the true recurrence rate for calcium oxalate or calcium oxalate-calcium phosphate stones is 8.1 per cent while for the secondary mixed calculi it is 28.3 per cent. As regards uratic calculi, it is difficult to know whether any stone fragments have been overlooked since they are radio-transparent. Hence it is impossible to differentiate between true and residual recurrence with this type of stone.

The frequency of secondary operation following conservative operative procedure for renal calculi should be noted. Of the 141 patients followed subsequent secondary operations were performed on 31, or 22.0 per cent of the original number. Of these 31 operations, 16 were secondary conservative operations while 15 were nephrec-

tomies. In other words, 10.6 per cent of the followed number of conservative operations required a subsequent nephrectomy. Thirteen followed a primary operation while 2 followed secondary operations. The indications for the 15 nephrectomies were: pyonephrosis with or without calculi, 9, chronic pyelonephritis, 1, persistent fistula, 4, and tuberculosis, 1. There were 55 patients, or 39.0 per cent, of the 141 who had either a true recurrence or a residual recurrence. It should be pointed out that a small number of patients with recurrence required secondary operation but refused. Six of the above mentioned 31 secondary operations were for conditions other than recurrence. On the other hand, it should be stressed that many patients with recurrence or residual recurrence were perfectly well, asymptomatic, and presented no indication for further operation.

Nephrectomy for calculous disease of the kidney or its complications was performed in 51 patients, or 12.1 per cent, of the 422 patients of this series, while conservative renal operations were performed on 169 patients, or 40.0 per cent. Seventy-three patients had a ureterolithotomy performed while the remaining number had either non-operative (such as cystoscopic) treatment or no treatment at all.

As judged by other reports, such as that of Priestley (26.2 per cent), nephrectomy has not been done as frequently here as elsewhere. It has always been felt, in this clinic, that conservatism which usually means conservation of renal tissue should be the guiding consideration in the treatment of renal calculi, especially in bilateral disease. Because of the reported high incidence of bilateral disease, nephrectomy in lithiasis has been performed only as a procedure of last resort even in unilateral cases.

Four patients died after the 51 nephrectomies, a mortality of 7.8 per cent. Of 34 patients on whom a primary nephrectomy was performed for an infected worthless kidney incident to calculous disease, 3 died, a mortality of 8.8 per cent, while in the group of 17 patients who had secondary nephrectomies performed, 1 died, a mortality of 6.0 per cent. There were 34 patients with unilateral and 17 patients with bilateral disease who were treated by extirpation, 4 of the former and none of the latter died after operation.

The mortality of 7.8 per cent appears high as compared with a report of Beer (2) from this hospital in 1920. He had only 1 death after nephrectomy in a group of 49 patients with extensive destruction of the kidney due to suppuration with or without stone, or a mortality of 2.03 per cent. Because of the present higher mortality, it is in-

teresting to review briefly in abstract the histories of the patients who died.

CASE 5 No 294200 S F, male, aged 55 years, presented renal symptoms of 1 month's duration. He had multiple stones in the left kidney and a single obstructing left ureteral stone. He died 36 hours following a left nephrectomy for atrophic kidney with multiple calculi.

Postmortem findings: unrecognized subacute bacterial endocarditis.

CASE 6 No 289780 W G, male, aged 35 years, presented a history of symptoms of 3 years' duration. He had undergone 3 operations as follows: March 13, 19.0, right pyelolithotomy, October 22, 19.6, left pyelonephrolithotomy, April 3, 1928, secondary left nephrectomy for left pyonephrosis with ureterocolic cutaneous fistula.

Postmortem findings: stercoraceous retroperitoneal phlegmon, fistulas from descending colon and left ureter into phlegmon, phlebitis of left renal vein, right pyonephrosis, left ureteral calculus.

CASE 7 No 348440 A M, female, aged 43 years, presented urinary symptoms of 7 years' duration. A right nephrectomy for calculous pyonephrosis was performed. Death followed operation from hemorrhage and shock.

CASE 8 No 292169 L M, female, aged 63 years, presented urinary complaints of 20 years' duration. A left nephrectomy for calculous pyonephrosis was performed. Death occurred 14 hours after operation, probably from cardiovascular collapse.

It will be seen that only 2 of these 4 patients had a simple primary nephrectomy performed for calculous disease of the kidney. Of the remaining 2, 1 had a complicated secondary nephrectomy and the other was operated upon because of a mistake in diagnosis.

In deciding the question of nephrectomy versus conservative operation in renal calculous disease, there can be no argument as to the advisability of extirpation in those unilateral cases in which the kidney is completely or almost completely destroyed by calculous disease with infection with no hope of return of function and in which the kidney is a permanent source of danger. The problem repeatedly arises, however, as to what procedure to use in certain borderline cases. A case with unilateral disease may present the following conditions either singly or in combination:

- 1 The kidney is considerably destroyed.
- 2 Extensive dilatation and deformation have taken place with the possible persistence of uncontrollable infection and residual urine in calyces and pelvis inviting recurrence.

- 3 Multiple or dendritic calculi are present which perhaps cannot be completely removed even under x-ray control and may serve as nuclei for further trouble.

- 4 Because of general and local symptoms, the kidney though possessing some function may cause chronic invalidism.

In these difficult borderline cases, will the individual be better served by a drainage operation

with removal of calculi (pyelonephrolithotomy or nephrolithotomy) or by the more radical procedure of nephrectomy? To decide this problem, the following factors should be considered

- 1 The mortality of the respective procedures
- 2 The frequency or habit of the patient to have difficulty with the same kidney in the case of a conservative procedure
- 3 The frequency of secondary nephrectomy after conservative operations
- 4 The frequency of complications and sequelæ following these procedures and the duration of convalescence with relation to the patients' economic status
- 5 The frequency of bilateral nephrolithiasis and involvement of the second kidney by calculous disease after nephrectomy or conservative operation on the first kidney

The following is a detailed presentation of the above mentioned factors which I believe should be taken into consideration

1 In this series there was no mortality after pyelonephrolithotomy in 22 cases and nephrolithotomy in 16 cases of unilateral disease. The mortality for pyelolithotomy for multiple or dendritic stones in 31 cases was 6.4 per cent. Because of the small number of cases these figures probably do not represent a true picture of the mortality. The statistics from Table I (all cases) may be nearer the true mortality rates for a larger group of cases. This is shown by Joly who, summarizing the collected statistics reported by Cifuentes, Braasch, Brongersma and Gian Vito Tardo at the above mentioned Congress held in 1924 found for pyelolithotomy 1,398 cases with 34 deaths, or 2.4 per cent, for nephrolithotomy, 2,045 cases with 212 deaths, or 10.3 per cent, and for nephrectomy 1,822 cases with 154 deaths, or 8.4 per cent. While the mortality for primary nephrectomy in this series was 8.8 per cent it is likely that with properly selected cases (Case 1 error in operative indication, Case 2 complicated case with ureterocolic cutaneous fistula) the mortality is lower. At any rate the mortality of the contrasting procedures is comparable and not of decisive import in unilateral disease.

2 and 3 The frequency of the total recurrence and residual recurrence in our carefully checked up cases is large. It is approximately 40 per cent for pyelonephrolithotomy and nephrolithotomy in unilateral cases. More than one third of the patients with recurrences are well and asymptomatic. Approximately 20 per cent of the total number of patients operated upon need secondary operations of which approximately one half require nephrectomy for recurrence, infected

worthless kidneys, or persistent fistulas. The results following pyelonephrolithotomy and nephrolithotomy are obviously poor. At least with removal of the kidney, recurrences and further operation for stones are impossible.

4 Even without complicated statistical data, it will be conceded that primary nephrectomy is usually a simple procedure and gives less postoperative complications than pyelonephrolithotomy or nephrolithotomy. The convalescence is usually much smoother, urinary leak or persistent fistulas, and postoperative renal hemorrhage are absent. Febrile reactions due to residual infection in a diseased kidney, i.e., pyelonephritis, and phlebitis of the renal vein are not present. Incidentally, 4 of the secondary nephrectomies performed were for persistent fistulas¹ in infected kidneys following conservative operations. Besides a smoother convalescence, the average stay in the hospital is shorter after nephrectomy. This is important from an economic standpoint.

5 It has been noted above that bilaterality was mentioned in 26.0 per cent of the 422 case histories analyzed. The criteria for classification of a case as bilateral have been stated above. More important than the actual percentage of bilaterality is the question as to how many cases thought to be unilateral when first studied showed involvement of the opposite kidney at a later date. Of 130 patients operated upon for renal calculi with follow up studies of from 1 to 7 years who were diagnosed as unilateral cases on first admission, 19, or 14.6 per cent, later presented evidences of calculous disease on the opposite side. The second kidney became stone bearing in 13 patients, or 15.1 per cent, of the 86 patients who had conservative operations performed on the first kidney. Of 27 patients who were nephrectomized for supposedly unilateral disease and who were followed on an average of 4 years, 4, or 14.8 per cent, developed definite evidences of stone in the other kidney or ureter. However in only one instance (Case 9) or 3.7 per cent was this involvement of the remaining kidney contributory to a fatal outcome.

CASE 9. No. 356922 B. K. aged 22 years presented a history of 1 year's duration. She had multiple stones in her left kidney for which a pyelolithotomy was performed. One month later a secondary nephrectomy for persistent lumbar sinus due to stricture at the pyelo-ureteral junction was performed. Seven months later the patient developed dendritic stone in the right kidney with acute pyelonephritis. Pyelolithotomy with decapsulation was performed but the patient died in uremia.

¹None of these fistulas was caused by overlooked stone fragments lying into the ureter—since it is a routine procedure on this service to place a temporary ligature around the upper ureter when operating on a stone kidney.

In this series, then, involvement of the opposite kidney by calculous disease following nephrectomy for unilateral disease occurred in approximately the same frequency as involvement following conservative operations. Most observers report an infrequent involvement of the second kidney after nephrectomy. Brongersma found that following primary nephrectomy for unilateral calculous disease, involvement of the opposite side occurred in only 1 case out of 53, or approximately 2 per cent. Braasch and Foulds found this occurrence to take place in 3 per cent of the cases, Twinem in 4.2 per cent, Rafin in 3 per cent while Winsbury-White found no subsequent stone formation on the opposite side in the 43 patients with unilateral disease upon whom he performed a nephrectomy. Winsbury-White advises nephrectomy in many cases of unilateral stone, to insure against pyuria, formation of stone in the second kidney, and continued ill health. Joly, in a discussion on calculous anuria, quotes Eliot who found that 23 out of 32 patients (i.e., 72 per cent) with calculous anuria had the opposite kidneys removed for calculous pyonephrosis. Despite this excellent indication in favor of conservative operative treatment, he argues for earlier nephrectomy stating that recurrence on the opposite side is uncommon after nephrectomy for stone and is usually found only when the infection has spread from the first to the second kidney. Of 377 patients with calculous anuria, Cahill tabulated 128, or 33.9 per cent, whose opposite kidney was absent, removed, or aplastic. Herman and Greene found that while calculous anuria occurs seldom after nephrectomy for conditions other than calculous pyonephrosis, it is rare if the remaining kidney is normal at time of original operation. There have been very few cases of calculous anuria seen on this service. This is believed to be due to the extreme conservatism which has been shown in the operative management of our cases.

It is difficult to understand why patients with unilateral disease who have been nephrectomized show subsequent involvement of the opposite side so infrequently when the acknowledged incidence of bilaterality is so much higher (15 to 30 per cent). Whatever the factors are in stone formation, one would think that nephrectomy for calculous disease would not change these factors. More in line with our statistics are those of Hellstrom and Cifuentes. Hellstrom found in his previous material that there was between 10 per cent and 11 per cent involvement of the second kidney after nephrectomy and between 6 per cent and 15.5 per cent involvement after conservative

procedures. After nephrectomy for staphylococcus stones, the opposite side was affected in 16.7 per cent. From these figures he argues in favor of conservative operation and states that nephrectomy is to be avoided at any price. Cifuentes, who noted bilateral disease in 20 per cent of his patients also had a 13 per cent appearance of lithiasis in the second kidney after observation or operation had been performed on the assumption that the disease was unilateral.

Concerning the involvement of the solitary kidney by unrelated disorders following nephrectomy for calculous disease, there is no evidence that such involvement occurs in any greater frequency than in people who have both kidneys. It is, of course, well known, that the loss of one kidney is usually of no great significance *per se*. Depending on the experimental animal used it has been found that as little as one-sixth the normal kidney tissue suffices to sustain life (14).

Summarizing, in the borderline type of case as has been outlined, nephrectomy is advised by many because the mortality is not higher, and one can thus avoid the high incidence of recurrence and residual recurrence, complication, and secondary operations with prolonged convalescence and subsequent economic loss found after the alternate conservative operative procedure.

The main objection to nephrectomy in unilateral calculous disease is that once a kidney is removed, it can no longer serve the patient, who, because of subsequent difficulty with the remaining kidney, may be in dire need of some additional excretory function. Of these patients 14.8 per cent developed calculi on the opposite side.

The fallacy committed in judging what procedure should be used on the basis of a statistical study is obvious. One never can be sure into what statistical group the individual patient under consideration will fall. While nephrectomy may be the method of choice in a majority of questionable cases, as determined by many considerations, it could not be so considered if subsequently, the patient should require additional excretory function due to serious calculous involvement of the previously normal kidney. While such later involvement is not common, it does occur and often when least expected. It has been the experience of this group (4), that on various occasions, conservative operation on a badly diseased stone-bearing kidney has paid great dividends when later involvement of the second kidney or ureteral blockade made the first kidney the sole excretory urinary organ. In addition, an astonishing improvement in function has been observed by almost all surgeons

after adequate drainage and conservative treatment of such a kidney

SUMMARY AND CONCLUSIONS

The true recurrence rates in all types of cases for pyelolithotomy, pyelonephrolithotomy, and nephrolithotomy were, respectively, 14.9 per cent, 32.0 per cent, and 29.4 per cent while the total rates of the true recurrences plus the residual recurrences were 24.0 per cent, 54.0 per cent, and 58.6 per cent, respectively. In unilateral cases, the true recurrence rates were 13.0 per cent, 23.5 per cent, and 23.1 per cent, respectively. The true recurrence rate for all conservative operations in the primary stone cases (calcium oxalate or calcium oxalate calcium phosphate) was 8.1 per cent while for the secondary stone cases (mixed calculi—salts of alkaline earths) it was 28.3 per cent.

Of 141 patients followed on whom conservative operations were performed 55 or 39.0 per cent, had either a true recurrence or residual recurrence while of 88 patients with unilateral disease, 25 or 28.4 per cent had either a true or residual recurrence. Not all of these patients had symptoms because of their recurrences. In fact the majority gave no evidence of trouble until roentgenograms were taken. There were 31 secondary operations performed or 22.0 per cent of the original number. Of the total number 15, or 10.6 per cent required secondary nephrectomy. The total incidence of bilaterality in this series was 26.0 per cent. Of the patients with unilateral disease 14.6 per cent had subsequent calculus formation on the second side after the original observation and diagnosis of unilateral disease, 14.8 per cent followed nephrectomy, 15.4 per cent followed pyelolithotomy, 9.5 per cent followed pyelonephrolithotomy and 23.1 per cent followed nephrolithotomy. While involvement of the second kidney after nephrectomy for unilateral disease is unusual as judged by the majority of reports in the literature, our statistics show that it may occur more frequently.

Notwithstanding several considerations suggesting the advantages of primary nephrectomy in certain borderline cases of unilateral calculous disease of the kidney it is believed that pyelolithotomy, pyelonephrolithotomy or nephrolithotomy with operative x ray control are pro-

cedures of choice and that conservatism should still be the main desideratum in the primary treatment of this condition. It is also felt that the results of the conservative procedures will improve with improvement of operative technique and x ray technique (both pre-operative and operative), and with the use of such post operative measures as possibly the high vitamin acid ash diet. The future will certainly bring to light additional aids in the technique of the operative procedures and in the prevention of recurrences, whether true or residual. Unfortunately, once a kidney has been removed, it can never be replaced, therefore every effort should be made to conserve it.

BIBLIOGRAPHY

1. BARNEY J D Recurrent renal calculi. *Surg Gynec & Obst.* 1922 35, 743-748.
2. BEER EDWIN Progress in nephrectomy. *J Am. M. Ass.* 1920 73, 1180-1184.
3. Idem. Points in the technique of operative removal of kidney stones. *Ann Surg.* 19 8 57 530.
4. Idem. Personal communication.
5. BRAASCH W F and FOULDS G S Postoperative results of nephrolithiasis. *J Urol.* 1924 11 525.
6. BRONGERSMA, H. Reports of Second Congress International Soc. Urol. Rome 1924, 1 357-431.
7. CABOT H and CRABTREE, E G Frequency of recurrence of stone in the kidney after operation. *Surg Gynec & Obst.* 1913, 21 223-225.
8. CAHILL, G F The medical and surgical treatment of calculous anuria. *J Am M. Ass.* 1933, 104 1306.
9. CIFUENTES PEDRO La litiasis—ren ureteral bilateral. Estudio clinico e indicaciones en su tratamiento. *Madrid Grafica Universal* 1933, Abstracted in *Arch Surg.* 1936 33 1008.
10. DE ILLYES GEZA Des calculs renaux recidivants. *J d urol.* 1934 38 410-432.
11. HELLSTROM JOHNS Staphylococcus stones—a clinical study of 90 cases. *Stockholm P A Norstedt and Sons* 1926.
12. HERMAN L and GREENE, L B Calculous anuria in acquired single kidney. *J Urol.* 1934 32 623.
13. JOLLY J S Stone and Calculous Disease of the Urinary Organs p 375. St. Louis The C V Mosby Co 1929.
14. OFFENHEIMER GORDON D Polycystic disease of the kidney. *Ann Surg.* 1914 100 1147.
15. PRIESTLEY, J T Surgical aspects of renal calculi. *Proc Staff Meet. Mayo Clin.* 1934 9 486.
16. RAFFA Résultats éloignés des opérations contre la lithiase rénale. *J d urol.* 1924 18 1, 3.
17. TWINE F P A study of recurrence following operations for nephrolithiasis. *J Urol.* 1937 37 259-266.
18. WINSBURY WHITE H P A review of one hundred and sixty two consecutive personal cases of stone in the upper urinary tract. *Brit. J Urol.* 1934 6 142.

THE INDICATIONS FOR VAGINAL HYSTERECTOMY

H D COGSWELL, M D, Tyler, Texas

VAGINAL hysterectomy is not a new operation, but it received scant attention until about 30 years ago. At that time Price of Philadelphia popularized it by leaving heavy clamps on the broad ligaments for 48 hours. This technique has lost favor since the advent of the Mayo operation which gives the bladder support and unites the broad ligaments in the midline by ligatures. The operation has had transient periods of popularity. Abdominal hysterectomy, on the other hand, has constantly been a dependable procedure maintaining its solid position as the operation of choice.

During the past few years the literature has contained many articles advocating more vaginal hysterectomies, increasing the indications, and giving statistics stressing the low mortality rate. Tyrone writes, "the indications have gradually extended until it is the accepted procedure in approximately one-half of the cases in which hysterectomy is necessary." Black recommends vaginal hysterectomy "with the full expectation that a few trials will prove its merit and warrant its more general use." Heaney reports 627 vaginal hysterectomies with but 3 deaths, and states "There has never been reported a series of hysterectomies by the abdominal route with so low a mortality rate." In a statistical study by Harris it was found that the mortality rate for vaginal hysterectomy was 2 per cent lower than for abdominal hysterectomy.

With such encouraging reports in the literature and the enthusiasm shown by advocates of vaginal hysterectomy, one is led to believe that this operation is to be chosen whenever possible. It was noted that the convalescence of patients who had undergone this operation was not as uneventful and uncomplicated as a perusal of the literature would lead one to believe. It was noted, generally, that the mortality rate was low but that the morbidity was higher than after abdominal hysterectomy. The younger patients did not have as smooth a convalescence as the older patients and had the more serious complications. It was also observed that many times technical difficulties arose which could not be foreseen and made the operation more hazardous than even a poorly performed abdominal hysterectomy.

From the Gynecological Service of the Indiana University Medical Center

It was thought that a comparative study made between vaginal and abdominal hysterectomies might show the cause of the existing inconsistencies. The patients studied were operated upon by a group of 11 surgeons, with enough difference in skill and experience to give results which should be those of an average surgical service. The operative technique varied to some extent, but all the surgeons did some modification of the Mayo operation.

A total of 179 consecutive vaginal hysterectomies was compared with 200 consecutive abdominal hysterectomies. In the abdominal group there were 108 supracervical hysterectomies and 92 panhysterectomies. The series were both large enough to permit a fair comparison. No cases were omitted in either the vaginal or abdominal series as it was felt that every case should be included to get an accurate idea of the relative values of the two operations. Each patient's postoperative days of morbidity were counted and averaged. Due to the observation that the more senile patients had the less severe convalescence, the patients were placed in age groups for comparison. The standard of morbidity used was a temperature of 100.5 degrees F or over, beginning with the first day after operation. The morbidity of patients weighing 160 pounds or over in the two groups was compared.

An attempt was made to compare the urinary complications. Those patients who received medication (urotropin, ammonium chloride, tincture of hyoscyamus, mandelic acid, sodium citrate, etc.) for the relief of genito-urinary complaints were recorded and compared. A comparative study was also made of postoperative complications. The mortality of the two groups was noted and the cause of death ascertained in each case by a postmortem examination (Table III).

Table I shows the days of morbidity in the different age groups. There was little difference in the days of morbidity between the two types of abdominal operation, averaging 2.9 days. Vaginal hysterectomies averaged 4.7 days of morbidity. Rinsman and Sellers observed that morbidity was more prolonged in the vaginal type of hysterectomy. Witherspoon and Butler also found this true and found that these patients had the longest hospital stay. In the age group of 50 to

TABLE I—AVERAGE POSTOPERATIVE DAYS OF MORBIDITY IN THE AGE GROUPS

Type of operation	Age years 20-30	Age years 30-40	Age years 40-50	Age years 50-60	Total average
Abdominal panhysterectomy	2.0	4.0	3.0	1.8	2.9
Supracervical hysterectomy	2.3	3.2	2.0	3.5	2.9
Total abdominal hysterectomy	2.1	3.6	2.0	3.1	2.9
Total vaginal hysterectomy	4.6	4.5	6.2	3.3	4.7

70 years it is seen that the average morbidity in the vaginal type of hysterectomy is practically the same as that of the abdominal operation and this is the only age group the morbidity of which can compare with the abdominal series. Every patient in this group was operated upon for the cure of procidentia.

Postoperative urinary complications were most common in the patients who were operated upon by the vaginal procedure. 45 per cent of whom received urinary medication as compared to 25 per cent in the abdominal cases. Harris reported similar findings in his series.

A list of the postoperative complications is shown in Table II. It is difficult to evaluate a comparison such as this, but it is obvious that the complications in the one group are balanced by similar complications in the other group. The abdominal operations however were done on the most difficult and complicated cases while the vaginal hysterectomies were all done on carefully selected patients. It is logical to assume that due to the moribund condition of some of the patients who were operated upon by the abdominal procedure the complications in this group should be expected to be more numerous and severe. Since the two series do balance so evenly it is strong evidence that an abdominal hysterectomy is the safer and is fraught with fewer postoperative complications than a vaginal hysterectomy, excluding cases of procidentia.

Wishard and Megenhardt made a study of the residual urinary symptoms and cystoscopic findings in these same patients. They found that the highest incidence of persistent symptoms is present in those patients who have had vaginal hysterectomies. This is consistent with the complaints registered by the patients examined in the postoperative gynecological clinic. In general the younger patients had the greatest number of residual symptoms. Next to bladder discomfort these patients complained of pain in the lower quadrants which was interpreted as being due to tension on the supporting pelvic ligaments. It was observed that patients who had been operated upon by the vaginal route for procidentia

had the fewest residual symptoms and were the more consistently relieved of their pre-operative complaints.

Table III gives the mortality rate and cause of death as confirmed by autopsy. The abdominal group had a mortality of 1.5 per cent compared to 0.5 per cent for the vaginal group. Vaginal hysterectomies, as stated, were performed on selected and uncomplicated cases. If abdominal hysterectomies had been done in place of vaginal operations on these patients it is most probable that the mortality rate would have been just as low. The 3 patients upon whom the abdominal operation was performed who died had peritonitis, 2 of them presented difficult conditions in which the bowel was unknowingly opened and 1, upon whom a total hysterectomy was performed, had a pre-existing cellulitis of the vagina. All of these patients presented technical difficulties which made a vaginal hysterectomy impossible. Two patients had old pelvic infections which caused adherence of the pelvic viscera to the intestine and the remaining patient presented an impacted fibroid.

Seventy-eight patients with procidentia were treated by vaginal excision of the uterus and repair of the rectocele and cystocele when present. There were 49 patients in the age group of 30 to 70 years who were operated upon for procidentia, and 29 patients in the age group from 31 to 49 years. In the older group the morbidity was 3.3 days and in the younger 3.6 days. The average morbidity of patients with procidentia was 3.45 days and this group of patients had the most uneventful convalescence, fewest complications, and the greatest amount of relief when examined 3 months after operation. With the good results obtained in these patients it is evident that a vaginal hysterectomy is a safe, curative treatment in cases of uterine prolapse with the associated cystocele and rectocele, irrespective of the patient's age. Richardson (9) states, "vaginal hysterectomy possesses distinct advantages over the abdominal route in properly selected cases," and further adds (10), "an attempt to broaden the scope of the vaginal operation beyond reasonable

TABLE II—NUMBER OF PATIENTS IN EACH GROUP WITH POSTOPERATIVE COMPLICATIONS

Complications	Abdominal panhysterectomy	Supracervical hysterectomy	Abdominal hysterectomy total	Vaginal hysterectomy total	Per cent	
					Vaginal	Abdominal
Wound infection	0	7	16	17*	0.0	0.8
Circulatory collapse	0	1	1	0	0.0	0.05
Pylorus	1	5	6	5	0.23	0.3
Peritonitis	1	1	4	1	0.05	0.2
Rectovaginal fistula	0	0	0	1	0.05	0.0
Eventration of the wound	0	1	1	0	0.0	0.05
Postoperative hemorrhage	2	1	3	3	0.16	0.15
Pelvic abscess	1	0	3	6	0.31	0.15
Thyroid crisis	1	0	1	0	0.0	0.05
Vesicovaginal fistula	2	0	2	2	0.11	0.1
Parotitis	1	0	1	0	0.0	0.05
Toxic encephalitis	1	0	1	0	0.0	0.05
Phlebitis	0	0	0	1	0.05	0.0
Pulmonary embolism	0	0	0	1	0.05	0.0
Fecal impaction	0	0	0	1	0.11	0.0

*Abscess in roof of vagina

limits makes it a mutilating procedure which serves only to discredit it and denotes neither sound judgment nor safe surgery."

The most common indications given by different writers for performing a vaginal hysterectomy were noted and were used in this series in an attempt to prove or disprove their justification. They are (1) elderly patients who are bad risks, (2) malignancies of the cervix, (3) laceration and infection of the cervix, (4) fibroids and fibrosis of the uterus, (5) procidentia, (6) obesity. In the series studied all the elderly patients were operated upon by the vaginal route for the same condition, procidentia. Since the only other common need for pelvic surgery in the senile is pelvic tumors, which certainly should be removed by the abdominal route, it was thought that the first indication could be omitted. Malignancies of the cervix were formerly treated by total hysterectomy, but recent reports (13) reveal that the prognosis is much brighter when radiation is substituted for surgery. This is consistent with the results obtained in this clinic. Lacerations and

infections of the cervix can be cured much more conservatively (2, 3) than by a vaginal hysterectomy, and there is no indication for such radical treatment. The hackneyed argument of carcinoma originating in the remaining cervical stump is still moot, but recent papers show this possibility to be negligible (5, 12).

If a vaginal hysterectomy could be done with ease in an obese individual, it would certainly be preferred to an abdominal operation. Surgery through a fat abdominal wall with a thick, bulky omentum always makes any operative procedure more difficult and is attended by a greater danger of postoperative hernia, but it is often impossible to determine the presence of masses or fixation of the pelvic viscera when examining a fat individual. The morbidity in the obese was higher in the vaginal series than in the abdominal. There was no death in either group (Table IV).

The perils encountered in a difficult laparotomy on an obese individual cannot compare with those present in a poorly selected vaginal hysterectomy. If it can be definitely determined before the op-

TABLE III—MORTALITY RATES IN SERIES

Type of operation	Number of deaths	Autopsy findings
Panhysterectomy	2	Peritonitis
Supracervical hysterectomy	1	Peritonitis
Vaginal hysterectomy	1	Pulmonary embolism
Abdominal	1.5%	
Vaginal	0.5%	

TABLE IV—MORBIDITY OF PATIENTS WEIGHING 160 POUNDS OR MORE

	Abdominal hysterectomy	Vaginal hysterectomy
Number of patients	14	17
Average weight	183	174.8
Average morbidity	4.3	6.05
Mortality	0	0

eration that there are no abdominal tumors and that the uterus and adnexa are not fixed so that the uterus can be prolapsed with some traction, the indications for a vaginal hysterectomy may be present. Two cases were encountered in which, at the time the vaginal hysterectomy was performed, pelvic disease which had not been suspected was found, and could not be dealt with because of its inaccessibility. Three patients, or 8 per cent, in the obese abdominal group developed hernias after operation. In every patient in whom a hernia occurred contra indications for a vaginal hysterectomy were present. It would seem that an abdominal hysterectomy on a corpulent individual is still safer than the average vaginal operation, except in cases of procidentia.

Morcellation may be required in order to remove a fibroid of the uterus by the vaginal route. This procedure has been advocated by several writers. Larkin seems to have a sane and conservative view on this practice when he states:

Morcellation which is advocated is a dangerous procedure. One never knows when a benign appearing fibroid or supposedly benign cyst is harboring a malignant cancer. One vesicovaginal fistula in this series was due to delivering a fibroid uterus of such large dimensions through the vagina that a portion of the bladder was torn away. There can be no argument that an abdominal operation is to be chosen by the average surgeon in removing a uterine myoma unless it is so small that its diagnosis is difficult. Vaginal hysterectomy for the removal of fibroids had the highest mortality rate of any type of hysterectomy in the series reported by Harris.

CONCLUSIONS

1 Prolapse of the uterus is the only indication for a vaginal hysterectomy.

2 The morbidity is higher in vaginal hysterectomy than in abdominal hysterectomy, except in procidentia.

3 The smoother convalescence of older patients upon whom a vaginal hysterectomy was

performed is explained by the fact that all the patients in this group were operated upon for procidentia.

4 Excluding cases of procidentia, the post operative complications and complaints are more numerous in the vaginal group than in the abdominal group.

Note—I wish to thank Dr W D Gatch for his aid and suggestions in the preparation of this paper.

BIBLIOGRAPHY

- 1 BLACK S O Vaginal hysterectomy. *South Surg* 1934 3 271
- 2 DANZIS, M Subtotal versus total hysterectomy. *J Med Soc N Jersey*, 1934 31 693
- 3 FINE S G Chronic endocervicitis and treatment by electro coagulation. *J Med Soc New York*, 1936 33 50,
- 4 HARRIS L J A statistical study. *J Iowa State M Soc* 1936 26 123
- 5 HEALY W P and ARNOLD A A study of carcinoma of the cervical stump developing after subtotal hysterectomy. *Am J Obst & Gynec* 1935 29 370
- 6 HEANEY, S A series of 627 vaginal hysterectomies performed for benign disease with three deaths. *Am J Obst & Gynec* 1935 30 269
- 7 LARKIN C L Discussion of paper by O N Eastman Vaginal Hysterectomy. *New England J Med* 193 212 37
- 8 OTTINGER R. Vaginal hysterectomy. *J Indiana State M Ass.* 1935 28 20
- 9 RICHARDSON, E H Total versus subtotal abdominal hysterectomy in benign uterine disease. *Am J Obst & Gynec* 1935 30 337
- 10 Idem Total hysterectomy by the abdominal versus the vaginal route in benign uterine disease. *Am J Obst & Gynec* 1936 32 641
- 11 RINSMAN J C and SELLERS T B Morbidity and mortality in 272 hysterectomies. *Am J Surg* 1935 27 282
- 12 SCHEFFEL L C Carcinoma of the cervical stump. *J Am M Ass* 1936 107 837
- 13 SHAW L F Radium versus Wertheim's hysterectomy in the treatment of carcinoma of the cervix. *Surg Gynec & Obst* 1937, 64 332
- 14 TYRONE, C H Vaginal hysterectomy—its indications, technique and end results. *New Orleans M & S J* 1935 88 400
- 15 WISHARD W and MELNHARDT D The bladder after hysterectomy. *J Urol* To be published
- 16 WITHERSPOON J T and BUTLER W Pan hysterectomy. *Am J Surg* 1933 22 361

EDITORIALS

SURGERY

Gynecology and Obstetrics

FRANKLIN H. MARTIN, M.D.
Founder and Managing Editor
1905-1935

ALLEN B. KANAVAL, Editor

Associates

LOYAL DAVIS

SUMNER L. KOCH

MICHAEL L. MASON

DOUGLAS C. BALFOUR, *Associate, Editorial Staff*

DECEMBER, 1937

THE JUSTIFICATION FOR STAGE SURGERY IN TOXIC THYROID DISEASE

AN INCREASING experience with thyroid disease should make one increasingly wary of generalizing concerning it, and it might seem that surgeons from regions in which goiter is non-endemic should refrain from such generalizations altogether. Yet even a rather limited experience permits the comprehension of tendencies, and one tendency seems fairly clearcut today, the use of the stage operation for toxic thyroid disease on rather shadowy indications.

Hertzler has very correctly said that while it is no disgrace to do in two stages what could have been done in one, to reverse the procedure and lose the patient is a very different story. That does not grant, however, a license for stage surgery in the absence of definite indications. With all its advantages, the two-stage or more than two stage operation can be overdone, and has all the defects of its merits. There are other considerations, aside

from the general principle that less surgery is always safer than more surgery. Every anesthetic, for instance, however skillfully given, implies a certain risk, minimal, it is true, but none the less present and not to be lightly waved aside. Every operation, however skillfully performed, has inherent in it certain risks—infection, hemorrhage, shock, embolism, nerve injuries, and similar predictable and unpredictable dangers and catastrophes. Every convalescence may possibly go astray. The patient who is submitted to stage surgery is given an additional safeguard from the standpoint of his toxic thyroid disease. That cannot be gainsaid. But it also cannot be gainsaid that he runs a double anesthetic and a double surgical risk. In certain cases that double risk is more than justified. In other cases the justification is at least debatable, with perhaps as much to be said on one side as on the other. But in some instances, and we are beginning to believe that the number is rather larger than is generally realized, the risk is not justified at all.

The question of when stage surgery is warranted in toxic thyroid disease rests first of all upon the premise that the supposed toxic disease is really toxic, and then upon the degree of toxicity. Of the justification for stage surgery in true toxic thyroid disease there can be no possible doubt. Every clinic which practices it has proved that point again and again, just as every surgeon who does not practice it has proved the point by the reverse method, the cases he has lost, the patients who should not have died. But that all patients on whom stage surgery is done are very toxic, or, to speak frankly, are toxic at all, we do not for a moment believe.

Lord Horder has recently and properly com-

mented upon the madness which seizes us all when the word thyrotoxicosis is bandied about, and has said that, if we must use it, the least we can do is to see that we are not mesmerized by it. His warning might well be heeded in any surgical community. Whether it is the tendency of all internes and all young doctors, as well as many older ones, to paint the picture of Graves' disease in all cases of goiter we do not know, but personal experience and the reading of the literature force us to the conclusion that the tendency is rather general. The historian who begins his anamnesis with the textbook picture of Graves' disease in his consciousness is likely to emerge from the endeavor with that same picture on the record, whether it should be there or not.

That the differentiation between toxic and non-toxic thyroid disease is always easy we do not for a moment claim. The taking of a history in such cases is often fraught with difficulty. Too many patients are prone to exaggerate their symptoms and to furnish any suggested to them. Too many patients seem unable to reply to any question as to their illness except in the affirmative. But it takes more than nervousness; it takes more than a story of palpitation, it takes more even than the visible evidence of a tremor to justify the diagnosis of toxic thyroid disease.

The mere presence of protuberant eyes does not establish the existence of exophthalmos. Many persons are born with such an abnormality and a simple question as to the duration of the supposed pathological change very frequently eliminates it entirely by the revelation that it has been present from birth. A high basal metabolic rate, in the absence of other signs and symptoms, is no evidence of anything. The time has long since passed when a single high reading, or even repeated high readings, would be regarded as of independent diagnostic value. But the individual

of limited clinical experience is very likely to misuse this test, very likely to base his diagnosis upon an initial or a single high reading, without regard to the other factors in the case or the environment in which the test was taken.

It is important, also, to disentangle the purely cardiac and purely neurologic patient from the supposed toxic thyroid patient. That the thyrocardiac, as such, actually exists we would be the last to deny. There is general approval of Lahey's stand that operation is indicated in this type of case, even in poor surgical risks, stage surgery has brought salvation to many such patients. But we have also seen purely cardiac conditions regarded as of thyroid origin, a lucky chance prevented the personal performance of thyroidectomy upon one such patient who had been treated medically for her supposed toxic thyroid disease over a long period of time, and the recollection of that case averted a similar error in another. Neurasthenic patients, again, have been submitted to stage thyroidectomy, without benefit, of course, and frequently with actual harm. Finally, the differentiation between toxic thyroid disease and early tuberculosis, obvious though it may seem, may be exceedingly difficult.

The supposed toxic thyroid patient who is prepared within a week and discharged within another after lobectomy, returning within a month or two for a repetition of the performance, can scarcely be regarded as a candidate for stage surgery. No truly toxic patient could be properly prepared within so brief a period, aside from the fact that the use of Lugol's solution would be entirely ineffective within it. It is in these and similar patients that we contend that stage thyroidectomy is resorted to without justification. Multiple surgery is done without indication or warrant when it is done for toxic thyroid disease which is only mildly

RELAYS ARE MADE THROUGHOUT THE
STATE OF NEW YORK

[illegible]

The 3rd of Oct 26. Looked at
 the 4th of Jan. — you of an old 1st class
 car (Eng/Am) in the station. I was
 nearly alone — but I got a fourth
 car. The 4th of Jan. I got a fourth
 car and got a 4th car.

I would prefer I have this
I'd just as well as pay for it as nothing.
Don't know how to do it. I don't like it.

(Eug. Spring)

LIST

Incumbents reduced in size, of passport (left) issued April 25 1797 to Nathan Smith and letter from trustees of Dartmouth College, written in August 1796, regarding the establishing of a professorship of theory and practice of Medicine at Dartmouth

EARLY AMERICAN MEDICAL SCHOOLS

DARTMOUTH MEDICAL SCHOOL

COLIN C STEWART, Ph D , Hanover, New Hampshire

DARTMOUTH MEDICAL SCHOOL was founded in 1797 by Dr Nathan Smith. Nathan Smith was born in 1762 at Rehoboth in Massachusetts but in his early boyhood the family settled in Chester, Vermont, across the Connecticut river from Charlestown, New Hampshire, Old Fort No 4 until then because of the French and Indian Wars about the northern limit of safe settlement. The upper part of the Connecticut was shortly thrown open for colonization, and settlers from Connecticut and Massachusetts were eager to avail themselves of the new opportunities. In fact, in 1769 one reason assigned for the selection of the present site for Dartmouth College was that it was the natural center of "more than two hundred towns, chartered, settled, or about to be settled."

Nathan Smith was an officer in the Vermont Militia at the close of the Revolution, and in 1783 he was teaching a district school in Chester where he had an opportunity to witness and assist in an amputation done by Dr Goodhue of Putney, Vermont. Smith applied for permission to study medicine under Dr Goodhue and was advised by him to spend a year in preparation, which he did, studying under the Rev Mr Whiting of Rockingham, Vermont. From 1784 to 1787 Dr Goodhue was his preceptor and in 1787 he began practice in Cornish, New Hampshire, where he remained for some years, except for the time spent at Harvard Medical School where he received the degree of M B in 1790.

The whole of the valley by that time was occupied by settlers to a degree that seems unbelievable at the present time, but a thorough study of any section of the region shows by its overgrown fields and pastures, by its stone walls and abandoned roads, its cellar holes and traces of orchards and gardens, that the country was covered by a close network of roads, dotted at regular intervals with dwellings, few remnants of which survive. The dwellers were undoubtedly poor in currency, but none the less well-to-do, for the presence near by of blacksmith shops and small mills made each community largely self sufficient. Transportation, judged by present

standards, was difficult and slow, but it is well to remember that narrow hillside roads long since abandoned and overgrown were as good as any for horseback travel. The main arteries of travel were the turnpikes upon which there were regular stagecoach routes with transportation for both freight and passengers. Even for journeys of considerable length no special hardship was apparent for there were many wayside inns where a change of horses could be made.

One reads of various explanations for the abandonment of these homesteads, of the influence of the growth of factory towns, of the coming of the railroads, of the opening of the West to settlement, and of the possible impoverishment of the soil. Undoubtedly a still more potent factor was a change in the means of transportation. Roads that were good for riding were difficult or impossible for wheeled vehicles, and little by little the more inaccessible regions were to be given up. The process is still going on with the replacement of horsedrawn vehicles by automobiles. Even the turnpikes are in many cases now well nigh impassable.

For these widespread and growing communities in Nathan Smith's time there was a scant supply of medical assistance. Travel was easy but time-consuming. With very few established medical schools in the United States, the preceptorial system was the recognized method of preparing for practice. In Cornish, Smith's success as physician and surgeon was so outstanding that except in the case of Lyman Spalding, it seems to have been physically impossible for him to give adequate instruction to the many applicants for his aid. And yet he was acutely aware of the needs of the now thickly settled Connecticut Valley in the region from Cornish north as far as the Ammonoosuc River. For these reasons he made application to the trustees of Dartmouth College for approval of a plan to establish a professorship of the theory and practice of medicine. Their action in August, 1796, while withholding actual support gave him such encouragement that in December of that year he sailed for Scotland where he studied at Glasgow and Edinburgh, later going to London, sending

back books and anatomical and chemical apparatus which were to be used on his return in 1797

The formal action of the trustees establishing the professorship is dated 1798, but the first course of lectures was begun November, 1797, as is witnessed by letters and by his daybook entries for that year. Two men were graduated in 1798. The first lectures were given in a building known as the Medical House, formerly standing to the west of the present building, since removed to the southwestern part of the town and still recognizable as part of a dwelling house. Later, lectures were given in rooms in Old Dartmouth Hall, but finally in 1810-11 the present "Medical Building," the oldest of the existing College group, was erected according to Dr. Smith's plans, partly by a small grant from the state, but largely at his own expense and on land deeded by him for the purpose. There have been many alterations in the original building, notably in 1871-73 when the Stoughton museum was provided for, and later by the addition of a wing for the anatomical laboratory.

In 1908 the Nathan Smith laboratory was built to accommodate pathology, histology, bacteriology and pharmacology. Courses in embryology and biological chemistry are given in the laboratories of the College. Clinical courses are held for the most part in the Mary Hitchcock Memorial Hospital which was built by Mr. Hiram Hitchcock in 1891-93, in response to the efforts and needs of the members of the medical faculty.

In the beginning Nathan Smith gave all the lectures and his popularity is attested by large attendance. The lectures in chemistry were soon turned over to Rufus Graves and later to Lyman Spalding (founder of the U. S. Pharmacopoeia). Doubtless this course, one of the earliest of its kind, attracted some of the students of Dartmouth College who registered for the medical lectures.

In 1813, discouraged by the state of affairs that culminated in the famous Dartmouth College case, Dr. Smith considered and accepted an invitation to be one of the group that gave the first courses at Yale Medical School. (He was also concerned in the founding of Bowdoin Medical College, 1821.) Nathan Smith returned to Hanover to lecture as late as 1816 but his remaining years were passed in New Haven where in 1829 he died.

The more inaccessible regions are now deserted except during the summer months. The distribution of the population has changed since Nathan Smith recognized the needs of the northern Connecticut Valley, and the nature of the need has changed, but the region still needs the stimulus and the support of a medical center in order that the earnest practitioners of the countryside may give their best to the people dependent upon them.

As was said in the presentation of the College case before the Supreme Court in 1818, Dartmouth "is only a small college but there are those who love it." The same can be said of the medical school.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE second, revised and reset, edition¹ of *The Diseases of Infants and Children*, by Griffith and Mitchell, an old standby in pediatrics, is in many ways a surprising piece of work. Its greatest value lies perhaps in the fact that in one volume so complete a pediatric practice can be included. It is well indexed and the bibliographies at the end of each chapter are remarkably up to date.

It cannot be said to be a new work because it contains much in the text which is of greatest interest from a historical point of view, for instance, the material on infant feeding, moreover, certain phases of pediatrics which are quite live subjects today are scarcely mentioned, notably erythroblastosis fetalis. Perhaps this is not too serious a criticism in view of the purpose for which this book was designed, it is a typical text and no text on a subject like pediatrics can be maintained up to date, for in a year or two what is now known about these controversial conditions might be quite antiquated.

The great value of this book lies in the sound common sense viewpoint taken by the authors, who speak from a background of vast experience and whose judgment, in so far as treatment is concerned, is the sort one would like to have used in his own family. Throughout the text are italicized sentences and paragraphs emphasizing the important points in the book.

This edition keeps a valued text as nearly up to date as is possible to keep such a work.

C. A. ALDRICH.

THE study of diet in relation to cancer is comprehensively discussed by Hoffman in his recent book², *Cancer and Diet*. The book is based on 20 years of research and a study of 2,234 questionnaires from living cancer patients and 1,149 non-cancerous controls. An extended review of cancer literature is included. The work is divided into four separate sections.

The first section is a historical review of the literature from 1777 to the present time. The second section deals with statistical facts relative to food consumption and the changes which have occurred during recent times. The purpose of this section is to illustrate the transition from the use of natural food products to modified food products, and to point to the introduction in this transition of many dangerous dietary factors.

Section three is a very thorough discussion of the metabolism in cancer as affected by organic and inorganic food compounds. Here we find many conflicting expert opinions, and this section is a veritable chaos.

The fourth section is a tabulation of general facts concerning cancerous patients and non cancerous patients as obtained from the questionnaires mentioned, and the author's conclusion is derived from them.

There is a 64 page appendix which is an extensive tabulation and summary. In its entirety the book is a valuable accumulation of interesting data and is recommended not only to those interested in cancer as related to diet, but also to those interested in metabolic studies and endocrinology.

L. M. ROSENTHAL

IN this monograph³ of 214 pages, Putti presents a complete review of the lumbar-sacral sciatic syndrome based upon a study of 1,121 cases. It is a compilation of what the author has presented in various papers and lectures with the addition of his more recent studies on the subject.

Three pages are devoted to the cervical thoracic brachial neuritis syndrome, and its similarity to the lumbar sacral sciatic syndrome is emphasized. The subject is presented in a well planned manner, beginning with the neuro osseous anatomy of the lumbar sacral region. Then the etiology of pain in sacralization of the fifth lumbar is presented with roentgenograms and line drawings made from the films.

The author offers several short case histories and comments thereon. Before presenting his theories of tropism he gives a good anatomical description of the lumbar vertebrae. Roentgenograms, diagrams, and photomicrographs are interwoven in order to elucidate the variations of the planes of articulations of the facets.

Congenital anomalies and arthritis are discussed. Several chapters are devoted to arthritis of the articular facets and four colored drawings supplement the text. The pen and ink drawings, made from films, complete the picture.

The entire subject is clearly and adequately presented in a manner that reveals the author's profound knowledge and ability as a teacher.

In succeeding chapters the problem of lumbar sacral disability associated with radiculitis and sciatica, is considered. Here the examination of the patient is supplemented by photograms revealing the point of buttock pain in relation to sciatic scoliosis.

¹THE DISEASES OF INFANTS AND CHILDREN. By J. P. Crozer Griffith M.D., Ph.D. and A. Graeme Mitchell M.D. 2d rev. ed. Philadelphia and London W. B. Saunders Co. 1937.

²CANCER AND DIET WITH FACTS AND OBSERVATIONS ON RELATED SUBJECTS. By Frederick L. Hoffman LL.D. Baltimore The Williams & Wilkins Co. 1937.

³LOWBOARTRITE E SCIATICA VERTEBRALE. SAGGIO CLINICO. By V. Putti Bologna L. Cappelli 1936.

The symptoms of muscle spasm in scoliosis with descriptive line drawings, photographs and roentgenograms, are given. Camptocormia and alternating scoliosis are clearly described. There are some excellent descriptions of the postural attitudes assumed to relieve pain. Diagrams of the distribution of the second, third and fourth and fifth lumbar and first and second sacral nerves, aid in understanding the localization of the pathological changes in the lumbar or sacral areas. This is supplemented by roentgenograms and photographs of the patients.

The discussion of nerve involvement includes the sensory, motor and reflex disturbances, trophic changes and sympathetic nerve involvement. All the neurological findings are correlated with the clinical examination and roentgenograms.

A chapter on diagnosis includes a differential of meningitic muscle spasm with scoliosis and ankylosing spondylitis, early Pott's disease, syphilis, neoplasms of vertebral or spinal cord origin, disturbances due to sacro iliac and hip joint pathology, intervertebral disc pathology, peripheral nerve lesions, and sciatic neuritis.

Fifty pages are devoted to treatment which includes a discussion of the methods of selection of proper therapy for the individual patient. It covers physical therapy, immobilization by casts, corsets and braces. A detailed description of the author's method of making removable plaster jackets and the hot air treatment is worthy of careful attention.

Surgical treatment considers in detail the indications, technique and case reports of laminectomy, arthrodesis, facetectomy, transversectomy, and meniscectomy for protrusion of the intervertebral disc.

The monograph is excellently and adequately supplied with 114 instructive photographs, diagrams and roentgen reproductions. There are 5 colored drawings of operative exposures which are excellent. The literature is freely quoted and a complete bibliography appears in footnotes. The monograph closes with 8 pages on injuries of the lumbar spine associated with sciatica.

PHILIP LEWIS

AWEALTH of information is contained in the authoritative volume¹ on thyroid gland disease by Means. The book represents the experience of a careful student, a medical man, not a surgeon, who has had the advantages of charity facilities for prolonged medical observation, active physiological and clinical research, and good surgical co-operation—a combination of advantages rarely found. The Thyroid Clinic of the Massachusetts General Hospital represents these factors. The literary style is worthy of mention; it is simple, readable and refreshing. Specific problems are usually attacked with reference to scientific data accumulated by the author's own research. Throughout the book, charts and diagrams present a very extensive material on thyroid physiology and disease.

¹THE THYROID AND ITS DISORDERS. By J. H. Means, M.D. Philadelphia: Montreal, London: J. B. Lippincott Co. 1917.

It will be a pleasure and an education to use this volume for study and reference.

PAUL STARR

A HIGHLY commendable plan is used by Shands in his *Handbook of Orthopaedic Surgery*¹ in discussing general joint phenomena, the causes of pathological changes in bones and joints and physical diagnosis in the orthopedic patient. Congenital deformities, affections of growing bone, affections of adult bone, infections of joints and chronic arthritis, are discussed. The author has stressed the importance of physiological and anatomical considerations in determining the diagnosis and treatment.

The book is divided into 24 chapters. 16 chapters discuss the pathological lesions of orthopedic surgery; 7, the lesions of various regions of the body; and 1 chapter, body mechanics and physical therapy.

The book is well planned, is easy to read and understand, and is a safe one for students. Brevity, which is one of its chief virtues, is at times too great. Fundamental facts and principles are given very concisely. Controversial points are not discussed but the book represents the consensus of the present day teachers of orthopedic surgery.

The illustrations, well selected and well spaced, are chiefly line drawings and diagrams and are most instructive. The illustrations of bursae are very effective.

This *Handbook of Orthopaedic Surgery* is a valuable book for the student and the practitioner of orthopedic surgery. If for no other reason than its extensive and excellent bibliography, it would be well worth its cost.

PHILIP LEWIS

THERE is no doubt that Bick has done a tremendous amount of collateral reading in order to place before the profession in so concise a form so much valuable information—both from the historical and the practical points of view—as is contained in his *Source Book of Orthopaedics*¹.

The subject matter is discussed under the headings, primitive man and ancient practices, middle ages, renaissance, 17th century, 18th century, and the modern period. Bick discusses physiology, pathology, and methods of practice of bone joint and muscle tendon surgery. His descriptions of non-operative orthopedics and the rise of orthopedic hospitals and institutions are very interesting and instructive.

The manuscript reads like a story book. The bibliography is invaluable. Every physician should have the book in his library and, when he wants an hour or two of intensely interesting and authoritative reading, this is one book that will not fail him.

There has been nothing that compares with this book since the classical *Masters of the Maimed* by Sir Arthur Keith.

PHILIP LEWIS

¹HANDBOOK OF ORTHOPAEDIC SURGERY. By Alfred River Shands, Jr., B.A., M.D. In collaboration with Richard Beverly Roney, B.A., M.D. St. Louis: The C. V. Mosby Co. 1917.
²SOURCE BOOK OF ORTHOPAEDICS. By Logan M. Bick, M.A., M.D. Baltimore: The Williams & Wilkins Co. 1917.

IN the symposium¹ on the relationship of trauma to disease, edited by Brahdry, the authors stress the fact that their discussions deal particularly with the effect of a single trauma, either physical or psychic, in evoking, precipitating, or aggravating disease. The book, which should be read with great interest by medical men who devote any part of their time to industrial casualty work, comes at a time when there is a distinct need for such a volume which will serve as a reference book giving the prevalent opinions as to the relationship between trauma and certain pathological conditions. The book should prove indispensable to men who appear before industrial boards or act as medicolegal advisors to the carriers of casualty insurance.

A wide variety of medical and surgical subjects is covered, the list of contributors is very imposing and is made up of outstanding men in their special fields. There are no illustrations in the book. It would be unfair to single out any chapter as being unusually well presented, but the reviewer found the chapter on "Trauma and Diseases of the Spine" unusually illuminating and the chapter on "Trauma and Neoplasms" to contain a wealth of valuable information.

The authors should be proud of this book. One feels confident that the many references which will be made to its contents will be very flattering to the contributors.

R W McNEIL

THE recent book² by Tchaperoff presents an excellent synopsis of the details of radiological diagnosis. The author lays great stress on a systematic study of the roentgenographic and roentgenoscopic findings, which must be analyzed carefully, step by step. Details are liable to be overlooked unless such a study is undertaken. The author seeks to inculcate and to illustrate by numerous examples, first from a general and then from a regional point of view, how to make a systematic study of the roentgenologic findings in the principal, as well as some of the rarer, diseases.

The arrangement of the work facilitates the making of a differential diagnosis. The illustrations are generous, some perhaps a little larger than need be, but with practically all of them, one can only express agreement and approval. The reviewer considers this an excellent type of textbook in radiological diagnosis and yet it contains enough information to be a valuable book for the desk of any diagnostician.

JAMES T CASE

THE relationship of blood pressure to protein intake in the diet is discussed by Harris in *High Blood Pressure*³. The book gives the results of a tremendous number of laboratory studies made upon

various constituents of the blood and urine of patients receiving high and low protein diets. The results of these determinations are given in great detail, but few records are given concerning the clinical findings of the patients under study. Dr Harris revives the more or less discarded concept that hypertension is definitely related to high protein intake in the diet. He goes so far as to predict that as soon as the public regulates its mode of living to only necessary dietary requirements, the incidence of "hypertony" will be materially reduced. The text makes little mention of other investigators' work in this field and there is a limited bibliography. The author's concept of hypertension is not in accord with the consensus of most modern writers on this subject. The book will be of interest only to those who wish to consider the studies of the author concerning the relationship of hypertension to protein intake in the diet.

CHAUNCEY C MAHER

THE first portion of Plesch's *Physiology and Pathology of the Heart and Blood Vessels*⁴ is devoted to a discussion of mathematical details of the physics of the circulation. The second portion of the book is concerned with cardiac insufficiency with relatively little correlation with the physics which the author previously discussed. Belying its title the book contains only minor paragraphs and illustrations of the pathology of the heart and blood vessels. There is practically no bibliography and the index is only fair. The book is well printed but cheaply bound. There is little to be said in recommendation of this text.

CHAUNCEY C MAHER

TWENTY-FIVE years ago Sir St. Clair Thomson first published a text based on his own clinical experience and observation in diseases of the nose and throat. It proved so popular and successful that it is now in its fourth greatly enlarged edition.⁵ V. E. Negus has contributed the section on diseases of the air and food passages. The book is rather complete, containing 1,000 pages with 400 illustrations and radiographic plates.

Basically the general scheme of the original text has been maintained, effort being made to treat the subject matter scientifically but at the same time to retain its readability and simplicity. The chapters on malignancy of the larynx are especially well written, while that on tuberculosis of the air passages written from the author's personal experience appears to cover the subject rather thoroughly.

Undoubtedly this latest edition will prove to be as useful as a text and reference work as the previous editions.

JOHN F DELPH

¹TRAUMA AND DISEASE. Edited by Leopold Brahdry. B.S. M.D. and Samuel Kahn B.S. M.D. Philadelphia: Lea & Febiger 1937.

²A MANUAL OF RADIOLOGICAL DIAGNOSIS FOR STUDENTS AND GENERAL PRACTITIONERS. By Ivan C. Tchaperoff, M.A. M.D. D.M.R.E. (Camb.). With a foreword by Philip H. Mitchiner M.D. M.S. F.R.C.S. Baltimore: William Wood & Co. 1937.

³OXFORD MEDICAL PUBLICATIONS' HIGH BLOOD PRESSURE. By I. Harris M.D. London: Oxford University Press 1937.

⁴OXFORD MEDICAL PUBLICATIONS' PHYSIOLOGY AND PATHOLOGY OF THE HEART AND BLOOD-VESSELS. By John Plesch M.D. (Budapest) M.D. (Germany). L.R.C.P. London: Oxford University Press 1937.

⁵DISEASES OF THE NOSE AND THROAT: A TEXTBOOK FOR STUDENTS AND PRACTITIONERS. By Sir St. Clair Thomson, M.D. F.R.C.S. (Lond.) F.R.C.S. (Eng.) LL.D. (Hon.) Winnipeg: Médécine diplômée en Suisse and F. E. Negus M.S. (Lond.) F.R.C.S. (Eng.) 4th ed. New York and London: D. Appleton Century Co. Inc. 1937.

The symptoms of muscle spasm in scoliosis with descriptive line drawings, photographs and roentgenograms are given. Camptocormia and alternating scoliosis are clearly described. There are some excellent descriptions of the postural attitudes assumed to relieve pain. Diagrams of the distribution of the second, third, and fourth and fifth lumbar and first and second sacral nerves, aid in understanding the localization of the pathological changes in the lumbar or sacral areas. This is supplemented by roentgenograms and photographs of the patients.

The discussion of nerve involvement includes the sensory motor and reflex disturbances, trophic changes and sympathetic nerve involvement. All the neurological findings are correlated with the clinical examination and roentgenograms.

A chapter on diagnosis includes a differential of meningitic muscle spasm with scoliosis and ankylosing spondylitis, early Pott's disease, syphilis, neoplasms of vertebral or spinal cord origin, disturbances due to sacro iliac and hip joint pathology, intervertebral disc pathology, peripheral nerve lesions and sciatic neuritis.

Fifty pages are devoted to treatment which includes a discussion of the methods of selection of proper therapy for the individual patient. It covers physical therapy, immobilization by casts, corsets, and braces. A detailed description of the author's method of making removable plaster jackets and the hot air treatment is worthy of careful attention.

Surgical treatment considers in detail the indications, technique and case reports of laminectomy, arthrodesis, facetectomy, transverse section, and meniscectomy for protrusion of the intervertebral disc.

The monograph is excellently and adequately supplied with 114 instructive photographs, diagrams and roentgen reproductions. There are 5 colored drawings of operative exposures which are excellent. The literature is freely quoted and a complete bibliography appears in footnotes. The monograph closes with 8 pages on injuries of the lumbar spine associated with sciatica. PHILIP LEWIN

A WEALTH of information is contained in the authoritative volume¹ on thyroid gland disease by Means. The book represents the experience of a careful student, a medical man, not a surgeon who has had the advantages of charity facilities for prolonged medical observation, active physiological and clinical research, and good surgical co-operation—a combination of advantages rarely found. The Thyroid Clinic of the Massachusetts General Hospital represents these factors. The literary style is worthy of mention; it is simple, readable, and refreshing. Specific problems are usually attacked with reference to scientific data accumulated by the author's own research. Throughout the book, charts and diagrams present a very extensive material on thyroid physiology and disease.

¹THE THYROID, AND ITS DISEASES. By J. H. Means, M.D. Philadelphia: Montclair, London: J. B. Lippincott Co. 1937.

It will be a pleasure and an education to use this volume for study and reference. PAUL STARR.

A HIGHLY commendable plan is used by Shands in his *Handbook of Orthopaedic Surgery*² in discussing general joint phenomena, the causes of pathological changes in bones and joints and physical diagnosis in the orthopedic patient. Congenital deformities, affections of growing bone, affections of adult bone, infections of joints and chronic arthritis, are discussed. The author has stressed the importance of physiological and anatomical considerations in determining the diagnosis and treatment.

The book is divided into 24 chapters. 16 chapters discuss the pathological lesions of orthopedic surgery; 7, the lesions of various regions of the body; and 1 chapter, body mechanics and physical therapy.

The book is well planned, is easy to read and understand, and is a safe one for students. Brevity, which is one of its chief virtues, is at times too great. Fundamental facts and principles are given very concisely. Controversial points are not discussed but the book represents the consensus of the present day teachers of orthopedic surgery.

The illustrations, well selected and well spaced, are chiefly line drawings, and diagrams and are most instructive. The illustrations of bursæ are very effective.

This *Handbook of Orthopaedic Surgery* is a valuable book for the student and the practitioner of orthopedic surgery. If for no other reason than its extensive and excellent bibliography, it would be well worth its cost. PHILIP LEWIN

THERE is no doubt that Bick has done a tremendous amount of collateral reading in order to place before the profession in so concise a form so much valuable information—both from the historical and the practical points of view—as is contained in his *Source Book of Orthopaedics*³.

The subject matter is discussed under the headings primitive man and ancient practices, middle ages, renaissance, 17th century, 18th century, and the modern period. Bick discusses physiology, pathology, and methods of practice of bone joint and muscle tendon surgery. His descriptions of non-operative orthopedics and the rise of orthopedic hospitals and institutions are very interesting and instructive.

The manuscript reads like a story book. The bibliography is invaluable. Every physician should have the book in his library and, when he wants an hour or two of intensely interesting and authoritative reading, this is one book that will not fail him.

There has been nothing that compares with this book since the classical *Masters of the Maimed* by Sir Arthur Keith. PHILIP LEWIN

²HANDBOOK OF ORTHOPAEDIC SURGERY. By Alfred R. Shands, Jr., B.A., M.D. In collaboration with Richard Beverly Roney, B.A., M.D. St. Louis: The C. V. Mosby Co. 1937.
³SOURCE BOOK OF ORTHOPAEDICS. By Edgar M. Bick, M.A., M.D. Baltimore: The Williams & Wilkins Co. 1937.

which concern the heart are classified and discussed at such length that the text requires more than 300 pages. Almost without exception the numerous illustrations are well reproduced. Kymography is discussed at some length and there are sections on vasography, arteriography, venography and lymphography. Altogether it is a well written and beautifully reproduced book and should interest everyone concerned in the study of the human heart.

JAMES T. CASE

AS stated in the preface by the author *Heart Failure*¹ is intended primarily for the practitioner. It would increase the knowledge of heart failure enormously and would improve the care of cardiac patients considerably if all general practitioners did read and study this new important addition to our medical literature.

The book is essentially an exposition of the various features of heart disease, although some attention is given to the description and enumeration of the ordinary signs and symptoms of heart failure. When the author discusses the latter aspect of the subject incompletely he refers the reader to appropriate articles for further study. The outstanding contribution of this volume is that it contains a complete exposition of the physiological and pathological mechanisms involved in the production of the various signs and symptoms of heart failure. With this are coupled clinical experiences that illustrate the points involved. We have had books of a theoretical and others of a purely clinical nature. This has attempted to combine both and has done so with unusual success. The subject of heart disease particularly lends itself to this close union for theoretical knowledge of the dynamics of the circulation has increased tremendously during the past decade or so and is indispensable for the understanding of the practical treatment of the cardiac patient.

The book contains thirty seven chapters. The early ones are given over to a discussion of the individual and specific manifestations of heart failure such as dyspnea, edema, cyanosis. These are followed by chapters on the types of heart disease producing the various forms of heart failure. Finally, the treatment of circulatory failure is considered. There are numerous and well chosen references to original articles on subjects under discussion. One can therefore quickly survey the background of problems both clinical and experimental.

Although the book is called *Heart Failure* and that is its main theme it contains much useful knowledge concerning heart disease. Particularly impressive is the discussion of the nature and mechanism of paroxysmal dyspnea, periodic breathing and orthopnea. The entire volume is a splendid addition to the recent publications that have come out in this country on the subject of heart disease. It ought to obtain the same enthusiastic reception on the part

of the medical profession as Dr. Fishberg's earlier book *Hypertension and Nephritis*.

SAMUEL A. LEVINE

IT has been a pleasure to survey the new edition of *The Operations of Surgery* by Rowlands and Turner.² Since the last edition which appeared in 1927 the medical profession has suffered a great loss in the death of R. P. Rowlands, the senior author. For the past two or three decades Rowlands has been one of the leaders in the field of English surgery and his guiding hand will be much missed at Guy's Hospital, where he has so faithfully served humanity and the medical profession. It is of interest to note that this work is the direct descendant of the *Operations of Surgery* by W. H. A. Jacobson which was first published in 1889.

Before his death, Rowlands had revised the chapters on peritonitis, operations on the stomach and duodenum, viscerotomies and chronic constipation and operations on the intestines. The chapters dealing with the preparation of the patient, operations on hernia, the spleen, pancreas, and rectum and the vertebral column have been revised by W. H. Ogilvie. The chapters depicting operations on the lower extremity and the tendons have been rewritten by Grant MacSise and A. Ralph Thompson has revised the chapters on operations on the kidney and ureter, bladder, prostate, urethra, and penis. Portions of the work pertaining to gynecology were revised by G. F. Gibbard and R. C. Brock has rewritten the section on thoracic surgery.

This work portrays English surgery in an accurate manner as we of the States conceive it; it displays conservatism as well as accuracy. The chief points of interest are a description of the indications as well as the contra-indications for the proposed operation, an accurate and clear description of the procedure, and a suggestion as to what possible complications may be anticipated. Surgical judgment is stressed as well as operative skill since 'Technical skill by itself may even be dangerous without the guidance of adequate knowledge and sound judgment.' The text is clear and the illustrations are many and strikingly instructive.

The impression is gained that pre-operative and postoperative care are not stressed as much in England as they are in America. The administration of water to maintain a proper water balance is very inadequately described and no definite regimen is given. In America this procedure, so well developed by Coller and his coworkers, forms much of the basis of proper pre-operative and postoperative care. The intravenous administration of dextrose solution and blood transfusion are rarely mentioned. For the treatment of biliary tract disease and to reduce the coagulation time of the blood to normal, the advice which is very briefly given is to administer calcium chloride intravenously as recommended by Walters.

¹HEART FAILURE. By Arthur M. Fishberg, M.D. Philadelphia: Lea & Febiger, 1937.

²THE OPERATIONS OF SURGERY. By R. P. Rowlands (London) F.R.C.S. (Eng.) and Philip Turner B.Sc. M.S. (London) F.R.C.S. (Eng.) 8th ed. Two volumes. Baltimore: W. B. Saunders Co., 1937.

in 1922 along with "carbohydrates and water freely by mouth and glucose and water by rectum." It has been proved that glucose is not absorbed from the colon and many individuals cannot tolerate enough water per rectum so that they may absorb a sufficient amount to maintain a water balance. It has been fairly definitely demonstrated by physiologists that sugar, calcium, and vitamin D are the protective agents for a disabled liver and that every effort should be put forth in their administration to assure the availability of a sufficient quantity of these substances over a period of time.

This edition again demonstrates the difficulty in making revisions of extensive works. Much material must be and is carried over lest the revision entail a complete rewriting. Due to this many references are not of recent date. It is noted that the statistics for the results of suprapubic prostatectomy are quoted from Freyer, 1911-1913, and those for results of operations for gastric and duodenal ulcers at a somewhat later date but not what the reader would like to know, i.e., what are the results now?

It may be an advantage to the experienced surgeon to find occasionally disagreements from what he may think generally accepted principles. Allusion is made to statements in the discussion of the treatment of appendiceal abscess. Relative to a "leak into the peritoneum" incident to the removal of the appendix imbedded in the wall of the abscess which seems to be advocated, the author states: "There is only one certain way of preventing this catastrophe and this is by first deliberately opening the peritoneum internal to the abscess, and packing off carefully before the abscess is opened." This advice, I am confident, is contrary to the generally accepted teaching in America and since it emanates from an authority in abdominal surgery warrants study. Differences of opinion deserve wholesome thought and often lead to better solutions of problems.

This work depicts a conservative attitude although many of the radical and formidable operations are described. It is interesting to note that transurethral resection of the prostate is not mentioned. This procedure which has met with great favor in America is not being used very extensively in England. A midway position is likely to develop. This work retains the great merit which it has gained in the past and it is hoped that the new collaborators will continue their interest in its perpetuation.

JOHN A. WOLFER

A SMALL book of 133 pages copiously illustrated with line drawings has been written by Spiers¹ and touches upon practically the entire field of fracture surgery. While the book is not encyclopedic in nature, important aspects are stressed, and the impression is gained that the book is intended to help students and internes rather than those whose knowledge of this field is more advanced. For this purpose, the book will serve as a valuable adjunct to the standard texts on the subject of fractures.

JAMES K. STACK

IN taking one joint and covering it thoroughly as Dr. Albee has done from the vantage point of his immense surgical experience, this book² can be compared to Dr. Codman's work on *The Shoulder*, both being very valuable and full of useful information for an orthopedic or general surgeon. The book deals primarily with operative treatment to which the bulk of the script and illustrations is given, but this is founded on an excellent base of anatomy, physiology, and some pathology, together with very helpful and essential advice on technical details of equipment, etc. As usual he makes the procedures advised seem so clear and easy that there is a risk that the uninitiated surgeon may be tempted into the very real difficulties which have a way of cropping up in even the most routine of hip operations. The chapter on fractures is by far the best and presents the whole modern group of operative procedures clearly, though he definitely advocates his own bone grafting method. Dr. Albee has seen the whole development of hip joint surgery and has made such outstanding contributions to it himself that he speaks with just authority. When he comes to tuberculosis of the hip in its non-operative aspects, there is a distinct slackening of interest and a proper balance is lacking, which is also noticeable in several of the later chapters which bring the book to a rather abrupt end. All in all Dr. Albee has given that extremely valuable quality to the book, namely, that any reader can see clearly that what he says and advocates is his own honest conviction based on long and wide personal experience. It is to be hoped that its success will tempt others to deal in the same spirit with other joints or anatomical provinces.

ROBERT W. JOHNSON, JR.

¹A BRIEF OUTLINE OF MODERN TREATMENT OF FRACTURES. By H. Waldo Spiers. A. B. M. D. Baltimore. William Wood & Co. 1937.
²INJURY AND DISEASES OF THE HIP. SURGERY AND CONSERVATIVE TREATMENT. By Fred H. Albee. M. D. LL. D. F. A. C. S. assisted by Robert L. Preston. M. D. New York. Paul B. Hoeber Inc. 1937.

Drugs, in obstetrics Initiation of respiration in asphyxia neonatorum clinical and experimental study incorporating fetal blood analyses, 601

Duct Stenson's Repair of traumatic fistulas of 355

Duodenum Experimental duodenal ulcer 150 Lipiodol visualization of bile tracts in lesions with jaundice 220 Gastro-intestinal hemorrhage ed 551 Resection of head of pancreas and for carcinoma—pancreato-duodenectomy 681 Fragmentation and expulsion of common duct stone into by using ether and amyl nitrite 695

EARLY American Medical School Dartmouth Medical School 845

Economic factor in thyroid disease Justification for stage surgery in toxic thyroid disease ed 841

Education interne Acute appendicitis with peritonitis, treatment and mortality 68

Elliott treatment as an adjunct to operation in sigmoidal diverticulitis 240

Empiricism in medicine ed 393

Endocrines background of toxemias of late pregnancy 480

Endometrium Cystic changes in 666

Enteritis Regional 1

Enterostomy Passing of ed 394

Epinephrine Surgical treatment of hypertension ed 113

Epiphysis Fractures in children 464

Esophagus Total gastric resection, experimental study 540

Ether Fragmentation and expulsion of a common duct stone into duodenum by using and amyl nitrite 695

Ettore Some observations on orthopedic surgery in Europe cor 717

Eye Röntgen therapy in epitheliomas of maxillary sinus 637

FALLOPIAN tubes Skin hyperesthesia in acute salpingitis 321 Peritoneoscopy 623 843

Famous autographs, ed 256 William Eustis 260 Dr Charles McBurney Muscle splitting or grid iron incision for appendectomy historical note op 715

Famous portraits John Hunter 1728-1,93 op 145 Works of art in medicine and surgery ed 256

Faldini Some observations on orthopedic surgery in Europe cor 717

Farr Robert Emmett, 396

Fascia New suture for tendon and repair 700

Feet Localization and removal of foreign (metallic) bodies 698

Femur Pregnancy complicating bone tumors 145 Fractures of neck of ed 721 Some observations on orthopedic surgery in Europe cor 717 Primary point of infection in tuberculosis of hip joint 721, Acute osteomyelitis of upper end of 753

Fibula, Bumper and fender fractures 690

Fingers Recurring myxomatous cutaneous cysts of and toes 289 Pedicle flap patterns for hand reconstruction 523

Fistula vesicovaginal Transvesical closure of employment of young technique for inaccessible 534

Foot Thomas G. Morton and Morton's metatarsalgia 398 Bumper and fender fractures 690

Forearm, Fractures of both bones of method of fixation 90 Congenital abnormalities—phocomelus and congenital absence of radius, 475

Foreign bodies Localization and removal of 698 Fractures, Additional advantages of Hawley table 228

Hanging cast in treatment of of humerus, 231 Early weight bearing in dislocation of ankle joint

379 in children 464 Bumper and fender, 690 of neck of femur, ed 721 Double pulley traction in treatment of humeral shaft 812

Freeman Leonard, 554

GALL bladder Treatment of acute cholecystic disease 19 Simple and effective method for closure of biliary fistulas 88 Further study of blood iodine changes in affections of 180 Technique of immediate cholangiography 217 Lipiodol visualization of bile tracts in lesions with jaundice, 220 'Acute cholecystitis—why delay ed 550 Fragmentation and expulsion of common duct stone into duodenum by using ether and amyl nitrite, 695 Operative cholangiography 702 Ganglia, lumbar sympathetic, Muscle plating extrapleural lumbar ganglionectomy 707

Gastroscopy Gastroscopic observations of postoperative stomach 447

Cause drainage Packing after pneumonectomy 178

Gliomas Radical versus more conservative attitude in treatment of brain tumors ed 233

Greenough Robert B., Cancer of breast 789

Gynecology Viewpoints relative to abdominal surgery and obstetrics ed 252 Skin hyperesthesia in acute salpingitis 321

HAND reconstruction of, Pedicle flap patterns for 523, Localization and removal of foreign (metallic) bodies 698

Hanging cast in treatment of fractures of humerus 231 Harelup, Problems of unilateral repair 348

Harrison Archibald Cunningham 118

Hawley table Additional advantages of 228

Head Dermoid cysts of and neck 48

Hemorrhage Neo-synephrin hydrochloride in treatment of hypotension and shock from trauma or 458, into the pleural cavity 485, Accidents in renal surgery 515

Hemostasis in thyroidectomy 73

Hernia Congenital umbilical 393

Hip Acute osteomyelitis of upper end of femur 753

Hip joint Primary point of infection in tuberculosis of 721

Hirsutism Pituitary basophilism review of 42 verified cases with report of personal case 644

Humerus Hanging cast in treatment of fractures of 231 Double pulley traction in treatment of humeral shaft fractures 812

Hypertension Surgical treatment of ed 113

Hypotension Neo-synephrin hydrochloride in treatment of and shock from trauma or hemorrhage 458

ILLEUM Regional enteritis 1 Resection of right half of colon 92 Ileocecal lymphadenitis in children 98

Ileus Passing of enterostomies ed 394

Ilium Pregnancy complicating bone tumors 145, Primary point of infection in tuberculosis of hip joint, 721

Incision Voelckers Radical operation for cancer of rectum with preservation of sphincter muscle 528

Muscle splitting or grid iron for appendectomy historical note 715 Halsted, Cancer of breast 783

Instruments and apparatus common duct decompression apparatus Advantages of gradual decompression following complete common duct obstruction 11

Hawley table Additional advantages of, 228 Hanging cast, in treatment of fractures of humerus 231 stone

intestinal clamp Method of intestinal anastomosis with new clamp 383 Rektus tube Cellulitis of neck requiring tracheotomy 536 peritoneoscopy and accessories Peritoneoscopy 623 843 empyema tube, Treatment of acute empyema 685 continuous

- suction irrigation system of closed drainage, Treatment of acute empyema, 685
 Willis forceps to remove foreign bodies Localization and removal of foreign (metallic) bodies, 698, Mirizzi for cholangiography
 Operative cholangiography, 702
 Double pulley traction in treatment of humeral shaft fractures 812
- Intestines**, Regional enteritis, 1, Resection of right half of colon, 92, Carcinoma of jejunum, 303, Method of intestinal anastomosis with new clamp, 383, Passing of enterostomies, ed 394, Gastroscopic observations of postoperative stomach, 447, Subtotal gastric resection for peptic ulcer, 489, Carcinoma of colon, treatment dependant on location of lesion, 505 cor 717, Total gastric resection, experimental study, 540, Gastrointestinal hemorrhage, ed 551, Some surgical aspects of tuberculous disease of abdominal lymphatic glands, 771
- Iodine**, Further study of blood iodine changes in affections of gall bladder, 180
- Iodine therapy**, Two stage lobectomy in poor risk patient with thyrotoxicosis, 385
- Iontophoresis** Treatment of thrombophlebitis, with acetyl beta methyl choline chloride, 100
- Ischium** Primary point of infection in tuberculosis of hip joint, 721
- JAUNDICE** Lipiodol visualization of bile tracts in lesions with, 220
- Jaw**, Hemorrhagic or traumatic cysts of mandible, 640
- Jejunum**, Carcinoma of, 303, Posterior gastrojejunostomy, unusual error in technique, 824
- K**eloids, following laparotomy, 376
- Kidney**, Surgical treatment of hypertension, ed 113
 Effect of surgical drainage on, declared functionless by present tests of renal function, 188, Pontocaine spinal anesthesia in urology, 389, Some aspects of malignant tumors of, 433
 Accidents in renal surgery 515, Nephrectomy versus conservative operation in presence of unilateral calculous disease of upper urinary tract, 829
- Knee** Study of Osgood Schlatter disease 33, Bumper and tender fractures, 690
- LABOR**, Analgesia, anesthesia and newborn infant, 23
 Landmarks in surgery, Trousseau and thoracentesis, 123, Thomas G Norton and Morton's metatarsalgia 398
 Muscle splitting or grid iron incision for appendectomy, historical note, 715
- Laparotomy** Keloids following, 376
- Larynx** Cellulitis of neck requiring tracheotomy, 536
- Lip**, Dermoid cysts of head and neck, 48
 Problems of unilateral harelip repair 348
 Five year end results in treatment of cancer of tongue, and cheek, 793
- Lipiodol**, visualization of bile tracts in lesions with jaundice, 220
- Liver**, Enterectomy in surgical treatment of hepatic cirrhosis or portal obstruction with ascites, 331
 "Acute cholecystitis"—why delay, ed 550, Peritoneoscopy, 623, 843
 Hepatic lesions of newborn, 748
- Liver cells** Advantages of gradual decompression following complete common duct obstruction, 11
- Liver deaths**, Further study of blood iodine changes in affections of gall bladder, 180
- Lung** Packing gauze drainage after pneumonectomy 178
 Thoracoplasty within the sanatorium 357, Treatment of acute empyema 685
- Lymph glands** Some surgical aspects of tuberculous disease of abdominal 771, of abdomen Ileocecal lymphadenitis in children, 798
- M**ANDIBL, Hemorrhagic or traumatic cysts of, 640
- Mastectomy**, Greenough technique of radical, 807
- Master Surgeon of America**, Archibald Cunningham Harrison, 118, Clement Cleveland, 257, Robert Emmett Farr, 396, Leonard Freeman, 554
- Maxillary sinus**, Roentgentherapy in epitheliomas of the, 657
- McBurney**, Charles, Muscle splitting or grid iron incision for appendectomy, historical note, 715
- Medicine**, Empiricism in, ed 393
- Menstruation**, Pseudomenstruation in human female, 30, Cystic changes in endometrium, 666
- Metatarsalgia**, Thomas G Norton and Morton's metatarsalgia, 398
- Method**, Exalto, Mann Wilhamson, Experimental duodenal ulcer, 159, Homans', Repair of traumatic fistulas of Stenson's duct, 355, Goetze, Radical operation for cancer of rectum with preservation of sphincter muscle, 528, tunnel, method for correction of uterine retroversion 679, Heyd thyroid exposure, Simplified procedure for thyroid exposure, 688, Greenough, technique of radical mastectomy, 807
- Morton**, Thomas C, and Morton's metatarsalgia, 398
- Mouth**, Dermoid cysts of head and neck, 48
- Moyman Memorial Fund**, cor 262
- Muscle** sphincter, Radical operation for cancer of rectum with preservation of, 528
- N**ASOPHARYNX, Chordoma, 40
- Neck**, Dermoid cysts of head and, 48, Cellulitis of, requiring tracheotomy, 536
- Neocaine**, Carcinoma of colon, treatment depending on location of lesion, 505, cor 717
- Neo synephrin hydrochloride**, in treatment of hypotension and shock from trauma or hemorrhage, 438
- Nephrolithiasis** Nephrectomy versus conservative operation in unilateral calculous disease of upper urinary tract 829
- Nerves**, superior laryngeal, Development of technique of thyroideotomy, presentation of method used in University Hospital, 493
- Nervous system**, sympathetic, Muscle splitting extra-peritoneal lumbar ganglionectomy, 107
- Newborn**, Analgesia, anesthesia and, infant, 23, Hepatic lesions of, 748
- Nose**, Dermoid cysts of head and neck, 48
- Notochord**, Chordoma, 40
- O**BESITY, Pituitary basophilism, review of 42 verified cases, with report of personal case, 644
- Obstetrics**, Analgesia anesthesia and newborn infant 23, Viewpoints relative to abdominal surgery, gynecology, and, ed 252, Endocrine background of toxemias of late pregnancy, 480, Initiation of respiration in asphyxia neonatorum, clinical and experimental study incorporating fetal blood analyses, 601, Hepatic lesions of newborn, 748
- Orthopedics**, Some observations on orthopedic surgery in Europe cor 717
- Osteomyelitis**, Acute, of upper end of femur, 753
- Ovary**, Skin hyperesthesia in acute salpingitis, 321, Lipid dermoid carcinoma in cystic teratoma of, 340, Peritoneoscopy, 623, 843, Pituitary basophilism, review of 42 verified cases, with report of personal case, 644
- P**AIN, Low back, and sciatica, its etiology, diagnosis, and treatment, 195

- Intrahepatic, Carcinoma of, 164** Resection of head of and duodenum for carcinoma pancreatoduodenectomy 681
- Parotid gland, Cellulitis of neck requiring tracheotomy 536**
- Pedicle flap patterns, for hand reconstruction, 523**
- Penis, Restoration of entire skin of 362**
- Peptic ulcer, Subtotal gastrectomy for 489**
- Peritoneoscopy 623-843**
- Peritonium, Acute appendicitis with peritonitis treatment and mortality, 68** Tunnel method for correction of uterine retroversion 6,9
- Phocomelia, Congenital abnormalities— and congenital absence of radius 473**
- Pituitary gland, Pituitary basophilism, review of 42 verified cases, with report of personal case 644**
- Pleurum, Hemorrhage into pleural cavity, 485**
- Pneumothorax, Lacking gauze drainage after 1,8**
- Pneumothorax, Hemorrhage into pleural cavity 485**
- Pontocaine, Spinal anesthesia in urology 382**
- Portal vein, Pterectomy in surgical treatment of hepatic cirrhosis or portal obstruction with ascites 331**
- Practifluorin, Vision in surgery, ed 712**
- Pregnancy, Complicating bone tumors 145** Relaxin in human serum as a test of 135 Endocrine background of toxemia of late 450 ectopic Uterine curettage as all in likelihood of 520
- Prostate, Pontocaine spinal anesthesia in urology 382**
- Pseudomenstruation in human female 30**
- Pubic, Pregnancy complicating bone tumors 145**
- Pulse, Blood volume changes during surgical procedures 41**
- Radiography, Some aspects of malignant tumors of kidney 444**
- Skin graft, sieve Modified full thickness for covering large defects 104**
- Smith, Nathan, Dartmouth Medical School, 845**
- Sodium citrate, Experiences of blood transfusion team, 54**
- Specialists, Vision in surgery, ed 712**
- Sphincter ani, Pathogenesis of anal fissure and implications as to treatment 672**
- Spine, Low back pain and sciatica, its etiology, diagnosis and treatment, 195** Additional advantages of Hawley table 228
- Sterility, Pseudomenstruation in human female, 30**
- Stomach, Gastrosopic observations of postoperative 441** Subtotal gastric resection for peptic ulcer, 489 Total gastric resection, experimental study, 540 Gastrointestinal hemorrhage ed 551, Peritoneoscopy, 623-843 Posterior gastrojejunostomy, unusual error in technique 824
- Submaxilla, Dermoid cysts of head and neck, 48**
- Surgery, technique, Disruption of abdominal wounds, report of 22 cases 16** plastic Modified sieve graft full thickness skin graft for covering large defects, 104 Viewpoints relative to abdominal gynecology, and obstetrics ed 352 complications Keloids following laparotomy, 3,6 postoperative complications Empiricism in medicine ed 393, Accidents in renal, 515 technique, Experiences of blood transfusion team 545 complications Gastrointestinal hemorrhage ed 551 training in Vision in surgery, ed 712 complications Blood volume changes during surgical procedures, 741 gastric complications, Posterior gastrojejunostomy, unusual error in technique 84 stage Justification for stage surgery in toxic thyroid disease, ed. 841
- Suture, New for tendon and fascia repair, 00**

Trauma, Neo synephrin hydrochloride in treatment of hypotension and shock from, or hemorrhage, 458
 Treatment, Empiricism in medicine, ed 393
 Trousseau, and thoracentesis, 123
 Tuberculosis, Primary point of infection in, of hip joint, 721, Some surgical aspects of tuberculous disease of abdominal lymphatic glands, 771

ULNA, Fractures of both bones of forearm, method of fixation, 95
 Pregnancy complicating bone tumors, 145

Ureter, Pontocaine spinal anesthesia in urology, 389, Some aspects of malignant tumors of kidney, 433

Urethra, Primary carcinoma of Cowper's gland, 238, Pontocaine spinal anesthesia in urology, 389

Urinary tract, Nephrectomy versus conservative operation in unilateral calculous disease of upper, 829

Urine, Effect of surgical drainage on kidneys declared functionless by present tests to determine renal function, 188

Urology, Pontocaine spinal anesthesia in, 389

Uterus, Peritoneoscopy, 623, 843, Tunnel method for correction of uterine retroversion, 679, Uterine curettage as aid in diagnosis of ectopic pregnancy, 820, Indications for vaginal hysterectomy, 837

VAGINA, Transvesical closure of vesicovaginal fistulas, employment of Young technique for inaccessible vesicovaginal fistulas, 534, Indications for vaginal hysterectomy, 837

Valve, venous, Effect of thrombophlebitis on, 310

Vertebra, fifth lumbar, Low back pain and sciatica, its etiology, diagnosis, and treatment, 195

WEIGHT bearing, Early, in fracture dislocation of ankle joint, 379

Wheat germ oil, in treatment of abruptio placentae, Endocrine background of toxemias of late pregnancy, 480

Wilms tumor, Some aspects of malignant tumors of kidney, 433

Works of art in medicine and surgery, ed 256

Wounds, abdominal Disruption of, report of 22 cases, 16

BOOK REVIEWS

- ALBEE, FRED H. Injuries and Diseases of the Hip Surgery and Conservative Treatment Assisted by Robert L. Preston 833
- BICK EDGAR M. Source Book of Orthopedics 848
- BOYD WILLIAM. An Introduction to Medical Science 557
- BRAHDY LEOPOLD and KAHN SAMUEL. Trauma and Disease Edited by Leopold Brahdy and Samuel Kahn 849
- CARTER J. BAILEY. The Fundamentals of Electrocardiographic Interpretation With a foreword by Horatio Burt Williams 718
- COLE WARREN H. and FLMAN ROBERT. Textbook of General Surgery 262
- DAVIDOFF LEO M. and DYAE CORNELIUS G. The Normal Encephalogram 831
- FISHBERG ARTHUR M. Heart Failure 852
- GIBSON JAMES E. Dr Bodo Otto and the Medical Background of the American Revolution 831
- GRIFFITH J. P. CROZER and MITCHELL A. GRAEME. The Diseases of Infants and Children 2d rev. ed. 847
- GUEDEL ARTHUR E. Inhalation Anesthesia a Fundamental Guide 719
- HARRIS I. Oxford Medical Publications. High Blood Pressure 849
- HOFFMAN FREDERICK L. Cancer and Diet with Facts and Observations on Related Subjects, 847
- HORSLEY J. SHELTON and BIGGER ISAAC A. Operative Surgery 4th ed. vols 1 and 2 556
- HOVELACQUE PR. MONOD OLIVIER and LARARD HENRI. Le thorax anatomie medico chirurgicale 127
- JESSEN H. Cytologie du liquide céphalo rachidien normal chez l'homme monographie critique et pratique 126
- JONA J. LEON. Kidney Pain its Causation and Treatment 400
- KEHRER ERWIN. Endokrinologie fuer den Frauenarzt in ihrer Beziehung zur Ovarialfunktion und insbesondere zur Amenorrhoe 719
- KEYES EDWARD L. and FERGUSON RUSSELL S. Urology, 6th ed. 261
- MALINOWSKY M. C. and QUATER E. Carcinoma of the Female Genital Organs Translated from the Russian by A. S. Schwartzmann 718
- MASON ROBERT L. Pre-operative and Postoperative Treatment 719
- MATHEY CORNAT R. Radiotherapie Gynécologique Curie et Roentgentherapie 126
- MEANS, J. H. The Thyroid and its Diseases 848
- MILES ALEXANDER and WILLIAMS D. P. D. Oxford Medical Publications. Operative Surgery 2d ed. 127
- MILLER WILLIAM SNOW. The Lung 401
- OSMAN A. ARNOLD. Oxford Medical Publications. Original Papers of Richard Bright on Renal Disease Edited by A. Arnold Osman 557
- PLESCH JOHN. Oxford Medical Publications. Physiology and Pathology of the Heart and Blood vessels 849
- PUTTI V. Lombardite e sciatica vertebrale saggio clinico 847
- ROESLER, HUGO. Clinical Roentgenology of the Cardiovascular System. Anatomy Physiology Pathology Experiments and Clinical Applications, 851
- ROWLANDS R. P. and TURNER PHILIP. The Operations of Surgery, 8th ed. Vol. 1—The Upper Extremity the Head and Neck the Thorax the Lower Extremity and Vertebral Column Vol. 2—The Abdomen 832
- SCHINDLER RUDOLF. Gastroscopy the Endoscopic Study of Gastric Pathology With a preface by Dr Walter Lincoln Palmer 830
- SHANDS ALFRED RIVES JR. Handbook of Orthopedic Surgery In collaboration with Richard Beverly Raney 848
- SPIERS H. WALDO. A Brief Outline of Modern Treatment of Fractures 2d ed., 833
- STONE WILLARD J. Bright's Disease and Arterial Hypertension, 261
- TCHAPEROFF IVAN C. C. A Manual of Radiological Diagnosis for Students and General Practitioners With a foreword by Philip H. Mitchner 849
- THOMSON SIR ST. CLAIR and NEGLIS V. E. Diseases of the Nose and Throat a Textbook for Students and Practitioners 4th ed. 849
- TITUS PAUL. The Management of Obstetric Difficulties 400
- WARBASSE JAMES I. ETTER, and SMYTH CALVIN MASON JR. Surgical Treatment a Practical Treatise on the Therapy of Surgical Diseases 2d rev. ed. vols 1 2 3 and index 830
- WEIBEL W. Lehrbuch der Frauenheilkunde Vol. 1 Geburtshilfe 718
- WERNER AUGUST A. Endocrinology Clinical Application and Treatment 719
- WESSON MILEY B. and RUGGLES HOWARD E. Urological Roentgenology a Manual for Students and Practitioners 126
- WHITE PAUL DUDLEY. Heart Disease 4th ed. 401

